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[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF EDITOR, WRINKLE DEPARTMENT,
MILWAUKEE, WIS., Oct. 25, 1905.

To the Members of the Western Gas Association: The next meeting of the Western Gas Association will in all probability be the last one, owing to the proposed merging of the three leading gas associations. Therefo e, every effort should be made to make it a rousing success in all respects, and it falls to my lot as Editor of the Wrinkle Department to again appeal to you for this department. I earnestly request those who have made promises of contributions to remember such as soon as possible, and I fully expect to hear from quite a number who have not made any promises, but who I know are in possession of something that would prove of value to the Wrinkle Department.

Yours very truly, B. MCADAM, Editor.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance,

Yours very truly. W. E. STEINWEDELL, Editor.

BRIEFLY TOLD.

FIRST ANNUAL MEETING, EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.—The first annual meeting of the named body was held in New York, October 31st. Headquarters were in the Hotel Astor, and the meeting room was in one of that hostelry's elegant and serviceable halls. The meeting was guided by Mr. W. W. Cole, of Elmira, as President, and Mr. T. R. Beal, of Poughkeepsie, as Secretary. Mr. Beal is also Treasurer of the Association. The attendance numbered 35, and the proceedings were of a very interesting order, even though Greater New York was not especially on hand to assist in the same. Mr. Robert M. Searle, of Mount Vernon, as active and chipper as ever, was in the fray of debate though, and what he did say was well said. President Cole's address on the "Aims and Objects of the Association," was a well thought out paper, the prevailing ideas therein being devoted to the business methods of gas and electric lighting companies rather than to the technical side of the trading, which course he more than justified in the cogent remark that the manufacturing part of the work was being thoroughly well attended to by the large associations. The address brought out a good discussion, prominent in which were pointed references to the agitation for municipal ownership, probable effects of legislation in force and to come, and the like. The first paper read (that by Mr. J. S. Wilkie)

LIBRARY OF CONGRESS

was in trend similar to President Cole's address. It was entitled, "Some Aspects of Supervision by the State of Gas and Electric Companies." We hope that the Association will eventually permit the publishing of the Cole and Wilkie messages. The morning session having been brought to a close, a very pleasant and satisfying luncheon hour was the prelude to the afternoon's work, which included several topics of interest. Chief amongst these were brisk and pointed presentations on "Economic Waste and Competition," and on "Extensions with Reference to New Business." The discussions thereon were entertaining and instructive. The ballot for officers resulted in the re-election of Mr. Cole to the Presidency, and of Mr. Beal to the dual place of Secretary-Treasurer. The meeting was a good one, and the Association will be heard from in many ways to the advancement of the objects for which it stands. The latter are well set forth in Article II., of its Constitution, which follows: "Its objects shall be to harmonize, protect and advance the interests of the gas and electric companies in the State of New York, including all questions of treating the manufacture, distribution and sale of gas and electricity for light, heat and power purposes, and to give such advice and assistance to the companies in its membership as may be consistent with the general interests of the industries and of the communities served."

DEATH OF MR. WILLIAM WELSH, SR.—With great regret we chronicle the death of Mr. William Welsh, Sr., the capable, efficient and respected Superintendent of Works, New York and Richmond Gas Company, Staten Island, New York. His death, which occurred Sunday, October 29th, at St. Vincent's Hospital, was the sad sequel to an operation for the removal of an intestinal cancer. Deceased was first employed by the Richmond County Gas Light Company, when his stepfather (Mr. John Curley) was taken into its service by Mr. Samuel R. Brick, the corporation's first President—in fact, its organizer—as Superintendent. The date of this employment was likely 1859, and it means that Mr. Welsh was on hand when the gas supply of Staten Island was first turned on. On the death of Mr. Curley, Mr. Welsh was chosen as his successor, and during all the changes that have been registered in the gas trading of Richmond county—including the Browning dynasty and the Lowe piracy to the current clean ownership—Mr. Welsh was the man in the works' gap. That he was well appreciated may well be proved by this extract from a letter to us from Mr. Thomas O. Horton, Manager of the New York and Richmond Gas Company, dated October 30th: "In Mr. Welsh the Company has lost a man of the true type of gas man. * * * Since our taking over the Company, Mr. Welsh worked with entire sincerity in the interest of the new Company. I personally feel that I have lost and that every officer and employee of the Company has lost, not only an associate, but a personal friend." There is the testimony of a young man to the personal worth of an old man.

NOTES—

MR. J. AUER has been appointed Superintendent of the Le Mars (Ia.) Gas Company. His near relative, Mr. Bascom Parker, controls the property.

THE gas division of the properties of the Fremont (O.) Gas and Electric Company will be rebuilt, as to the generating apparatus, next spring.

MR. W. A. ALDRICH and associates will not construct the promised gas plant for Wallace, Idaho.

AT the annual meeting of the Stillwater (Minn.) Gas and Electric Company the officers elected were: President, E. L. Hespes; Vice-President, J. H. Brown; Secretary and Treasurer, J. G. W. Johnson. The plant will be enlarged in 1906.

THE main offices of the C. H. Geist Company have been transferred to commodious quarters in the Land Title Building, Philadelphia.

THE Wausau (Wis.) Gas Company has succeeded to the business and franchises of the Wausau Gas Light and Coke Company. Its officers are: President and Treasurer, K. L. Ames; Vice-President, Albert E. Smith; Secretary, J. C. Markley; Manager, J. H. Farrell.

THE United States Civil Service Commission announces an examination on November 22, at the Brooklyn Post Office, to secure eligibles from which to make certification to fill about 6 vacancies in the position of electric assistant in the Signal Service at large, for a period not exceeding 6 months, at the rate of $75 per month during such employment, and vacancies as they may occur in any branch of the service requiring similar qualification. Applicants should at once apply either to the United States Civil Service Commission at Washington, D. C., or to the Secretary of the Board of Examiners at the New York Custom House for application, Form 1,312. No application will be accepted unless properly executed and filed with the Commission at Washington.

Address of the President of the American Gas Light Association (Mr. E. G. Cowdery, St. Louis, Mo.), on the Occasion of Its Thirty-third Annual Meeting, Milwaukee, Wis., Oct. 18-20, 1905.

Gentlemen of the American Gas Light Association: It gives me a great deal of pleasure to open this 33d annual meeting of our Association here in Milwaukee. This is my home city where I have labored and gathered some 26 years' of my experience in this business. For several years it has been my desire to invite the Association to meet here, but each year other plans were made for it, and I awaited the proper opportunity to carry out my wishes. I had expected that when you did come here I should be able to greet you as host of the occasion; but the fates have been against me in this, and ere your coming my labors were transferred to other fields. It seems fitting, however, to state—and it is coincident with the occasion— that at the time chosen to meet here, where I can properly call it my home, I am serving as your President, and at a time that celebrates the 30th anniversary of my introduction into the gas business, and the 20th anniversary of my connection with this Association.

In addressing you at this time it is not my purpose to try your patience by occupying your attention for any length of time, but rather as concisely as possible, do that which I understand is the privilege, and perhaps the duty, of your President—state the opinions which he holds upon some of the leading questions of the day, thus laying bare to the world his innermost thoughts.

Price of Gas.—One of the most urgent and foremost questions before us at the present time is the price at which gas shall be sold. When gas is sold at $1 per 1,000 cubic feet anywhere in this country, it is cheap, and I do not wish to impress anyone with the idea that, so far as its cost to the ordinary consumer is concerned, there is need for a lower price; but it seems to be the opinion of the "public" that public serving corporations can sell their product at constantly reducing prices. As what has been accomplished in the past and up to the present time has, I believe it will be generally admitted, been to the advantage of the supplying company, the "public" cannot understand why matters cannot be pushed another notch and accomplish greater things for both parties. It may not stop to consider that there is a limit to the possibility of price reduction. Anyone will admit that gas cannot be sold at less than its cost of production. Anyone should admit that there must be added to its production cost a sum per 1,000 feet sufficient to maintain the plant, to pay all costs of distribution, accounting, management, taxes, etc., and to this extent there can be no difference of opinion when the facts are known; but where the operating companies and the public sometimes "split," and the paths of their arguments diverge, is over the question of reasonable returns upon the investment.

It is time for us to meet this question in a way that the public will understand our position thoroughly. It should be borne in mind that we sell our product at a fixed price or scale of prices, based upon cost of commodities that are entirely beyond our control. As these costs may advance to a point sufficient to wipe out our profits, therefore it is necessary to fix such prices upon an average cost of such commodities through a term of years, and not assume any one year as a basis. I might cite an example of a company paying a price for materials, etc., items beyond its control, which, compared upon a basis of prices paid three years and more previously, show an increase considerably over one-half million of dollars per annum. This sum must naturally come out of its profits, and, for the purpose of illustration, I will say that the amount is greater than that company has ever paid out in dividends in any one year.

Therefore, in fixing a cost price of gas, due latitude must be given for such variation in cost of materials as is taken into consideration by other manufacturers, were they to undertake to fix the selling price for the products they distribute through a term of years, reaching into an unknown future.

It is often claimed that the lower the price of gas the greater the amount of the business to be obtained, and thus make possible the accumulation of a larger aggregate profit. To what extent the consumption will be increased by a lower price has been to a great extent an unknown quantity, but at the present time I believe our knowledge is such that this factor is fairly well established. Through the great range of price of artificial gas during the last 30 years, from $4 to $1 per 1,000 feet, and of natural gas from 50 cents to 7 cents, the almost universal average of consumption is $40 worth of gas per consumer per annum, no matter what gas is being furnished or for what purpose it is used, as long as the figures represent the general average of consump-

tion per consumer for the district supplied. Generally speaking, the lowest figure is about $25, and the highest I have known is $55, with the general average hovering close around $40. With such a figure at hand, and knowing the average investment per consumer, the cost of production, maintenance and operation, making due allowance for the possible deviation from the average cost and for depreciation, which sooner or later must be taken into account, it should not be difficult to determine the possibilities of the situation. But it should not be lost sight of that the figure so determined will only be obtained by unusual good judgment, and with care and thought and close attention; and, therefore, it will be considered for some time to come an experiment, with doubtful results whenever the price is reduced below $1 per 1,000 feet.

To those that have made, or are contemplating, reductions, I would call attention to the immense amount of depreciation of plant that has taken place during the last 30 years, and also to the further depreciation that will take place in the future.

Have our cost figures reflected these items of cost? If not, then we are deceiving ourselves only to suffer later on. There are a sufficient number of cases in sight where the depreciation must be made good by the expenditure of immense sums in the early future, which illustrates the point to which I refer.

Notwithstanding these doubts and uncertainties that are before us, the "public" is demanding a reduction in price as vigorously as it did a few years since when the $1 price was reached for the first time. This demand is coming more extensively at present in the larger cities; we have had several examples of it during the past year. This demand cannot be stilled, but must be met on the part of the companies with the spirit of endeavoring to find the way to successfully comply. To those believing a future lower price is possible, and to those finding it necessary to comply somewhat with the public demand, I believe the safer and better method is to make small reductions periodically until the minimum figure is found where it is possible to conduct the business upon sound business principles.

In this endeavor to reach the lowest possible figure with the greatest measure of success, even our larger cities must recognize the fact that in serving consumers using less than $1 worth of product per month there is no profit. Care should be exercised, therefore, to keep this consumer upon a basis of paying his own way and not be dependent upon the large consumer to make good the deficiency caused by the small one.

Publicity.—In this same connection I wish to bring out another thought that has not in past years been practiced or popular, and that is the principle of publicity. I believe many of our troubles come from a lack of knowledge and appreciation on the part of the public of the methods employed by the gas companies in the conduct of their business.

The gas companies are perfectly honest in the measurement and billing of their product; they are honest in the treatment of the public, and in conducting their business in a strictly legitimate way. They wish a proper profit upon the investment, and that only, but it should be borne in mind that they are entitled to, and should have, a sufficiently increasing profit where unusually good service to the public is accomplished to furnish the necessary incentive to produce further and greater results in the future. If the incentive is insufficient or is removed the ambition is killed, and the public should, and I believe will through any extended time give reward to the individual or corporation that shows the proper spirit toward the public in its management.

How can we expect the public to know or appreciate our efforts unless we make them known? If it is met with a spirit of frankness in all things it will believe in us in matters where it is necessary for it to exercise confidence. Abuse its confidence once and it may be gone forever. As the purposes of our companies and ourselves are honest in every particular, as it costs something to manufacture gas, something to maintain the plant and distribution system through a series of years, something for the distributing, accounting management and taxes, and as the total of these must be represented in a cost upon each 1,000 cubic feet sold annually, why would it not be better to educate the public to the true facts concerning methods, management and costs than to allow it to remain under a cloud of obscurity, deceiving the public to our own detriment?

There seems to me little to be lost and much to be gained by allowing and even educating the public to become acquainted with all the facts and establishing that confidence to which we are entitled, and which we can easily have for the effort. Personally, I believe in publicity of all public-serving corporations, and if it ever comes about that the results of our efforts and operations are published broadcast the greater portion of our troubles will have disappeared.

I will merely chronicle here that I am not a believer in State Commissions as they have been established by the laws in Massachusetts, and more recently in New York. I believe they serve to retard and obstruct the development of the business they are supposed to control, because the laws governing such bodies are too stringently framed. Publicity, with good management and due regard for the rights of the public, will prevent any need or call for State Commissions.

Taxes.—While referring generally to the subject of legislation, I want to call attention to the lack of uniformity of the laws of the various States governing the taxation of gas companies.

It has for a considerable time been my idea that for our general information the different practices in the various States should be outlined, and from this outline the work should be taken up of perfecting the best system of taxation of gas companies, and securing the enactment of such laws as will remedy existing inequalities and unify the laws in this respect throughout these United States. I believe our brother, McLean, in the paper he will present at this meeting, will complete the first step of this work, and I would urge upon the members gathered here that they do not allow the work to lag, but step-by-step carry along a work for which I believe there is such great need.

This is a great body of intelligent men. I believe no other body of equal numbers ever gathers that outranks this one in intelligence; and as this body is supposed to be, and undoubtedly is, thoroughly acquainted with the business it is conducting, therefore it is evident that you are better able to frame a law governing the needs in the taxation of our business than any other body of men. Undoubtedly the laws governing the taxation of gas companies must apply to all other quasi-public corporations, the aid of the electric light and street railway associations could be secured, and the co-operation of these interests must exert a great influence in securing any just and equitable laws.

I earnestly recommend that this Association carefully selects a committee to enlist the co-operation of the electric and street railway and telephone associations, and together with committees from such associations form a taxation law equitable to all, which may be uniformly adopted by all the States, and through the co-operation and efforts of the companies located in the States secure the passage of such a law.

Condensation.—Among the subjects that I wish to call to your especial attention, and one which I believe deserves more study than we have heretofore given it, is that of condensation. I believe there is much in the condensation of gas that we do not know. There may be many gentlemen present who have a general theoretical knowledge of how the condensation of gas should be accomplished; but is there a gas works in this country where the condensation of gas is properly carried out?

I am in hopes that the papers and discussions at this meeting may teach us much in this direction. It is undoubtedly true that the higher the illuminating power of our gas the higher should be the effective heat units; but how many of us follow up this subject with our photometers and calorimeters at every step of the process of condensation and purification to see whether these conditions always follow?

Where I have seen this work carried on I have observed at times the higher illuminating value producing the lower heat units, and *vice versa*, so it appears there is a constantly changing chemical combination of gases producing the different results. Is it caused in the manufacturing process, or during the condensation or purification?

We all agree that we must bring our gas not only to the highest possible efficiency in heat units, but we must hold such heating effect constant and regular.

We are approaching the day when candle power must be relegated to an inferior position to heat units, and to replace the laws now governing candle power we must be able to produce better results for the consumer in other ways, be able to show the reason therefor, and to know what we can constantly produce in an economical manner. The condensation of gas is one of the great problems before us, and it is to be hoped that in the early future the subject will have the study and attention it deserves.

Distribution.—During the remarkable development of the business taking place at the present time, especially when we do things to develop rapidly and during the time of diminishing prices, the growth has been extensive and so rapid that, unless a great amount of attention has been given the planning of the distribution system, it has been very apt to have become outgrown, and we are suddenly brought to realize that a great work is ahead in rearranging the system for present and future needs. Having once fallen behind, the cost of putting the system into shape is so alarming that it often is difficult to secure the necessary appropriation for the work.

For some years we have heard discussion at various times of the distribution of gas under high pressure. We all know that when illumi-

nating gas is subject to too high compression there is a percentage of loss of the illuminating effect. The limit of compression is, therefore, when the loss is compensated by the benefits derived. So far as our practice has obtained, at present such limit is from 30 to 40 pounds per square inch of pressure. At this pressure neither the illuminants nor heat units are materially affected.

There is, however, an intermediate system, which provides for the compression of gas in large quantities at a lower cost per unit than is possible under the high pressure system. This is known as the "booster system," and is more properly applicable in our larger cities, being used as a feeding system to supply the old, outgrown distribution system with a sufficient quantity of gas, and at a sufficient and equal pressure. The pressure at which such a system is operated is usually from 5 to 6 pounds per square inch, or, in other words, as high as can be most economically obtained with the rotary blower. In future years we shall hear much more of high pressure distribution with the gradual passing into obscurity of our old, low pressure systems. By no other than some high pressure system can we hope to as well give every consumer the even and constant pressure he requires and make the service satisfactory.

To those who have doubts of the wisdom of handling gas under high pressure, I would say, give up sufficient time to a thorough investigation and allow yourself to judge of the results as you see and find them, after having freed your mind of all prejudices concerning the subject.

Gas Meters.—As the subjects that have been in my mind have been the subjects of our paper lists, I do not wish to neglect the gas meter, although I am satisfied the treatment by the paper to be presented to the meeting will cover the subject thoroughly.

That the gas meter as it exists is an honest and correct measurer of the product it passes is shown by the fact that in this world of progress there has been no remarkable change or improvement in the gas meter, and no change in its principle for the last 40 years. I have known parties of more than the usual amount of originative and inventive ability that during this time have constantly tried to produce an instrument simpler and more perfect than the present meter, but they have failed to do so.

Nowhere in this wide world during that time has an instrument been devised that was more accurate for the purpose than the common and long known tin gas meter. There have, of course, from time to time been improvements in the details of the manufacture of the meter, and there is now, I believe, a movement to further perfect the meter, which will have a tendency to cheapen its cost per unit of capacity, and which will put into the consumer's premises an instrument that will give better service throughout the entire time of its use, yet there is no change in the principle of the meter. Why, then, should there be so much ridicule of the meter? Suppose we tell all these facts to the public as we tell each other and as we know them ourselves. Would it not have the tendency to establish confidence in the little, much-abused instrument.

Municipal Ownership.—It is my purpose to have the subject of municipal ownership of gas properties quite thoroughly digested at this meeting. We shall have presented to us a paper upon this subject that contains a great deal of information, but I am sorry to say that the necessary information to enable an actual comparison to be made between municipally owned and private companies is not obtainable at present from any published matter. I shall let that paper speak for itself and shall not attempt to discuss the subject, but I would urge on this Association and all other Gas Associations to adopt means and methods at once to continue vigorously the study of this question, to collect all the facts connected with the successes and failures of municipally owned and operated plants. Such facts and figures, correctly compiled and truthfully presented, will themselves combat all the arguments of the theorists in favor of municipal ownership.

While European methods are not to be compared with ours, on account of the difference in the system of municipal and general government, still I believe if all the details of costs, with the general conditions surrounding their municipally governed plants, were entered opposite the same details of costs and conditions of some of our privately operated plants, they would not show as favorably for the municipal plants as some would try to make us believe.

At present we nave not the details and facts concerning these plants, and they are not obtainable unless some one makes it a specific work to gather them and put them together. This Association could not do a better work than to find the way to collect this information for the benefit of all. It is true that with its present resources it has not the means to accomplish much; but why stop at that? This Association has the prestige that would enable it to obtain what many a private individual could not. It has fhe knowledge of the requirements and the necessary energy. It is an important work and a proper one for this Association to undertake. With a little effort I am quite sure the necessary funds could be obtained for the work.

Secretary's Requirements.—I believe it essential at this time to call your attention to some of the necessities of the Association. I find only those coming into close contact with the work of the Secretary know or appreciate the amount and character of such work and its requirements, and you will appreciate that it is a subject that the Secretary, whoever he may be, feels much delicacy in bringing out himself. Previous to the present year the office received $600 per annum. Commencing with last October the amount was raised to $750, with $250 additional allowance for stenographer's expense.

For this amount the Secretary is expected to attend meetings, make up, edit and keep all proceedings, take care of the Association library, keep on file all the various journals, blanks, forms, etc., carry on all correspondence in preparation of meetings, and many other things too numerous to mention and which I am not sufficiently acquainted with to enumerate. It is necessary for him at present to provide his own office and stenographer. The accumulation of files for years needs a storeroom. The library needs a room, and 1 or 2 other rooms should be provided for work rooms.

If you are not to have a Secretary who devotes his whole time to the work of the Association, you will need to provide not less than $2,000 per year for office rent and expenses beside the amount of compensation to be paid the Secretary. It would be much better if this Association could rise to a plan of providing a man to fill the office of Secretary who would devote his entire time to the work of the Association. The entire expense of keeping and conducting the office in such case, including the compensation to the Secretary, would likely approximate $5,000 per annum. It is, therefore, advisable for you to take the proper steps to provide additional funds to carry on the work of the Association growing in numbers and in importance and usefulness, and I advise that some such action be taken in contemplation of this and other means.

Research Committee.—Your Research Committee will present to you at this meeting an elaborate system of standards of cast iron pipe and fittings which it is calculated will replace the obsolete standard heretofore adopted. It has, as it will report to you, secured the co-operation of the principal iron and pipe foundries, to the extent that they have agreed to provide all patterns, and will to the extent they find it advisable carry a stock corresponding to the specifications provided in these standards. These standards have been provided with great care, and by men with sufficient experience, and I am sure they can be adopted by this Association with little question. In future years, with a single standard for cast iron, gas pipe and fittings, the obtaining of such supplies will be found much simplified.

Consolidation of Associations.—At the last meeting of the Association a committee was selected to act with a similar committee from each of the other Associations throughout the country to determine the advisability, and if found advisable to recommend measures providing for the amalgamating or consolidating of the different Gas Associations into one large national body for the purpose of economizing, simplifying and enlarging the scope of Association work.

This committee held a meeting in New York in February, and decided that the amalgamation as proposed was advisable, if a way could be found to accomplish it that would meet with the approval of all parties. In accordance therewith a sub-committee was selected, smaller in number and located within easy reach of New York, so that future conferences might easily be held to find the means, if possible, to accomplish this much desired result in a way that all might acquiesce and join in the movement. This sub-committee has made its report, and the full committee has considered and adopted it, and through your Council will recommend its adoption on the part of this Association at this meeting. My only request is that it will be considered upon its merit, without any feeling of prejudice. We are all working for the common good, and only such action should be taken by this or any other Association as will result in a common benefit and be adapted to the growing need and usefulness of Association work.

Deceased Members.—Before closing I hesitatingly and feelingly refer to those dead brothers who for years have been a part of us, and some of whom at least have met with us so regularly that for some length of time we shall look for their faces before realizing that they have departed from their earthly labors.

Mr. Edwin Ludlam, of Brooklyn, N. Y.; became a member in October, 1873.

Mr. James Somerville, of Indianapolis, Ind.; elected to membership in October, 1875.

Mr. J. T. Herron, of Buffalo, N. Y.; elected to membership in October, 1890.

Mr. J. W. Gwynn, of Bucyrus, O.; elected to membership in October, 1890.

Mr. J. A. Harris, of Philadelphia; elected to membership in October, 1886.

Mr. Edward L. Bartlett, of Baltimore, Md.; elected to membership in October, 1886.

Mr. Ludlam was one of the organizers of this Association, and while he had not been active in his membership in later years, was formerly one of the well-known representatives of the industry in the Eastern portion of the country.

Mr. Somerville was one of the older members, entering when the Association was but two years old. He was an ex-President of the Western Gas Association, and with the exception of the past few years actively participated in the work of this and other Associations of which he was a member. He was for years recognized as an authority in gas matters. The other gentlemen I have mentioned, whose names and faces were so familiar to you all, I am sure their presence will be missed through many repeated meetings.

It is the custom of the Secretary to have prepared and preserved in his files an obituary of deceased members, and the same custom will be followed in this instance.

We wish it might be that there should be no separation from those we have worked with, and with whom we have looked forward to meeting again as dear brothers and friends upon a congenial ground.

Methods of Charging for Gas.

[A paper read by MR. A. E. FORSTALL, of New York, at the Thirty-third Annual Meeting, American Gas Light Association, Milwaukee, Wis., Oct. 18–20, 1905.]

As far as the writer's knowledge goes, this paper is the fourth one on the subject of "Methods of Charging for Gas" that has been read before the Association. The first, read in 1891,[1] and the second, read in 1898[2], dealt principally with the question of the equity of the common practice of charging for gas at a fixed price per 1,000 cubic feet which was the same, either for all the consumers supplied by a company or for all of those in certain classes, without any regard to the differences in the cost of supplying different consumers arising from the different conditions under which the supply is taken in each case.

The author of the first of these papers, Mr. Walton Clark, submitted that it was inequitable to "Collect upon the investment necessary to the service of one customer an interest greater or less than is paid by any other customer upon the investment made in his behalf," as was necessarily done when the charge for gas was simply a uniform price per 1,000 cubic feet, and that the equitable way of charging for the service furnished by the gas company was "To charge for each 1,000 cubic feet of gas an amount covering its proportion of the items of expense and interest common to the performance of the total service, adding to each bill so made the items peculiar to the individual service." The charge per 1,000 cubic feet should include the cost of supplying up to the inlet of the service pipe, including the amount per 1,000 cubic feet necessary for the payment of interest and dividends, and the individual items should be made up of the average cost of keeping the accounts, collecting the bills and attending to complaints, plus the interest and maintenance charges for the meter and service pipe employed for the particular consumer under consideration.

In the second paper the present writer, who was forcibly impressed, upon taking charge of the commercial after a service of 12 years on the engineering side of the gas business, with the number of consumers who instead of bringing in a profit were actually a source of loss, when the expense of taking care of their accounts and the interest on the cost and the expense of maintaining their services and meters were taken into consideration, showed the effect that the system of charging advocated by Mr. Clark would have if applied to the gas company which he was then managing. For that particular case it was shown that the total cost per consumer of the maintenance of service, interest, depreciation and repairs on meters and labor, keeping the consumers' ledgers, making out and distributing bills, collecting the money for gas sales and attending to complaints, were, for an average length of service but for different sizes of meters:

3-light meter,	$2.25	per year.	20-light meter,	$3.30	per year.
5 " "	2.50	"	30 " "	3.80	"
10 " "	2.90	"	45 " "	4.90	"

60-light meter, $6.20 per year.

Therefore, before the company came out even on the business of any consumer using a 5-light meter it was necessary that he should consume in a year an amount of gas that would bring in a profit equal to $2.50. If fixed charges on the amounts named above had been made, and the price charged per 1,000 cubic feet of gas reduced to such an extent that the gross revenue from fixed charges and gas sold remained the same as the gross receipts from gas sales at the higher price per 1,000 cubic feet without fixed charges, the consumptions at which consumers would pay exactly the same amount in each case were:

For a consumer using a	3-light	meter,	19,000	cubic feet.		
" " "	5	" "	21,000	"		
" " "	10	" "	24,000	"		
" " "	20	" "	28,000	"		
" " "	30	" "	32,000	"		
" " "	45	" "	41,000	"		
" " "	60	" "	52,000	"		

Under the existing conditions the 63 per cent. of the consumers who used smaller amounts than these were not paying their proper share of the profit earned by the company, while the 37 per cent. using larger amounts were paying more than their share.

These papers received very little attention when they were read, the authors being told that they were probably right as to the equity of the proposed method of charging but that it was impracticable and never could be put into operation.

The third paper was read by Mr. F. W. Frueauff, at the last meeting of the Association. It approached the method of charging for gas along the line that had been followed by Mr. H. L. Doherty, in working out the system of charging for electricity which is named after him. In this system a prominent place is given to the cost incurred by the electric company to enable it to take care of the maximum demand of the consumer, and a special charge is made to cover this cost under the name of a "maximum demand charge." In applying the method to the gas business this feature is retained, and it is proposed to make a maximum demand charge in addition to the consumer's charge and to that per 1,000 cubic feet of gas sold. It is stated that an analysis made of the accounts of a gas company "brought out the startling fact that 19 per cent. of all consumers did not pay their output and consumer costs, that 34 per cent. did not pay their manufacturing, meter and demand costs, and that only 34 per cent. paid all the costs they occasioned, or that this 34 per cent. paid enough in excess of a reasonable amount to enable the company to make good its loss on the unprofitable consumers. This leads to but one conclusion, that they are doing business with a great number of consumers that are losing them money each month, and that they are selling them a very small quantity of gas, and from the other end of the table they found that from the comparatively few consumers who were using a large percentage of gas they were making a large profit after paying all costs." It will be noted that the percentage of consumers carrying more than their share of the burden in this case does not differ materially from the corresponding percentage as given in the second paper. To remedy these conditions, it was proposed to put into effect "An optional system of charging whereby any of their consumers can buy gas by paying $12 per consumer per year, plus $15 per 100 feet of maximum demand, plus 60 cents per 1,000 cubic feet for gas."

It does not seem to be necessary to repeat the arguments advanced in these papers, and never refuted in the discussions upon them, in favor of the system of charging outlined. The system advocated in the last paper read is rather more elaborate than that advocated in the other two papers, but there is good reason for making charges of the character described in that paper. No information is given, however, as to the manner in which the amount of the maximum demand charge, which is not nearly as important in connection with the gas business as it is with the electric business, and that of the consumers' charge, which are named in the paper are determined to be the proper and equitable ones for this particular case, and, since maximum demand and consumers' charges that are not based upon actual costs are just as inequitable, and, therefore, in the long run just as bad policy, as a simple uniform charge per 1,000 cubic feet, and as these charges seem to me to be entirely out of proportion to the cost of the service, I propose to take up the question of the items that should be included in each charge and of the approximate value of these items. In doing this the classification

1. "Meter Rents: Question of Equity and Policy." Proceedings American Gas Light Association, Vol. IX., page 317.
2. "Can We Make All Our Business Pay?" *Ibid*, Vol. XV., page 25.

of the standard system of accounts adopted by the Association will be followed.

The items of cost that are imposed upon a gas company by the fact that the demand of each consumer for gas is not uniform, but varies from hour to hour and from day to day, are those involved by the extra investment in plant required to supply the maximum demand over and above the investment that would provide all the plant called for by the average demand. No labor costs need be taken into consideration, although the intermittent working of a part of the apparatus, which is made necessary by the fluctuations in demand, does involve a slight extra cost for labor; this is so small in proportion to the other items as to be fairly negligible. The maximum demand charge is, therefore, made up of:

Interest and depreciation upon the cost of the portion of the manufacturing plant required to take care of the excess of the maximum make over the average make. The extra cost of maintenance involved by the use of this portion of the manufacturing plant. Interest and depreciation on the extra cost of the street mains actually required, on account of the size of the maximum demand, over the cost of the mains that would be required to take care of the average sendout. The extra cost of maintenance of street mains involved by their larger size, owing to the maximum demand. Interest and depreciation on the extra cost of service pipe actually required on account of maximum demand over the cost of the pipe that would be required for the average consumption. The extra cost of maintenance of the service pipe involved by its larger size. Interest and depreciation on the extra cost of the meter actually required on account of the maximum demand over the cost of that which would be sufficient to supply the average demand. The extra cost of maintenance of meters involved by this extra size.

Taking up these items in the order in which they are given, which is not only their order in the sequence of manufacturing and distributing operations, but is also, with the exception of the maintenance items, their order in importance, the first to be considered is the interest and depreciation on the cost of the excess plant made necessary by the maximum demand.

It would seem that to make an equitable charge on account of this item the conditions must be taken as they actually exist, and not as they would exist if the gas company were supplying each of its consumers singly. Thus all that has to be provided for is the maximum demand resulting as an average of the maximum demand of all the consumers combined, and, therefore, this item has no relation to the maximum demand of any individual consumer and must be averaged among them all. To obtain its value accurately it is, of course, necessary to consider all the conditions of each individual case; but, for the purpose of getting an approximate idea of what it should be, it can be worked out, assuming that the maximum day's make is $\frac{1}{365}$ of the annual sales and that the average sales per consumer will be 25,000 cubic feet per year. If the average sales per consumer are larger than this it is practically certain that the maximum day's make will be a smaller proportion of the annual make and the increase in one direction is offset by the decrease in the other, so that the figures obtained on this basis will be fairly approximate.

The extra plant required by the excess of the maximum demand over the average demand will include the entire holder capacity and 165/365, or 45 per cent., of the total manufacturing plant. Assuming average conditions as to the holder capacity provided, and as to the cost of holders and manufacturing apparatus, the excess investment at the works, made necessary by the excess of the maximum demand over the average demand, will be $25 per consumer. Taking interest and depreciation on this investment at 10 per cent., the annual charge per consumer will be $2.50 per year. By a calculation, the details of which it is not necessary to give, it is found that under the conditions named the extra cost of maintenance of the manufacturing apparatus and holders involved by the intermittent use of the former will amount to 30 cents per year per consumer.

As far as the street mains are concerned few if any gas companies have a maximum rate of sendout per hour which is larger than 1/1,600 of their total yearly sales, and as the average sendout per hour is 1/8,760 of the yearly sales the maximum demand requires that the street mains have a carrying capacity of $\frac{8,760}{1,600} = 5.5$ times that which would be required if the demand were perfectly uniform throughout the whole year. In the average street main system the average size of main works out a little under 6 inches in diameter, both as to size and as to cost of laying. If the sendout were absolutely uniform it would only be necessary to have a street main system equal on the average to pipe of 3 inches in diameter, since a 6-inch pipe has a carrying capacity practically 5.5 times that of a 3-inch pipe. The difference in cost between a 6-inch main and a 3-inch main would not vary very much from 25 cents per lineal foot in any locality. It is not out of the way to take an average of 100 consumers per mile, or one consumer for every 53 feet of main. The excess investment in street mains per consumer caused by the maximum demand will, therefore, be 53 by 25c. = $13.25, and interest and depreciation on this at 10 per cent. will amount to $1.33 per year. This is also an average charge resulting from the combined demands of all the consumers, and is, therefore, to be averaged among them and not to be calculated on the maximum demand of the individual consumer. To a certain extent the maximum demand of each consumer will influence the size of pipe laid in his immediate vicinity, but this is comparatively such a small matter that it would not seriously affect the amount of the figure derived above.

It is rather difficult to figure the extra cost of maintenance involved by a street main system of an average of 6-inch pipe instead of one of an average of 3-inch pipe. Under ordinary conditions the cost of street main maintenance depends largely upon circumstances the effect of which is not increased by increase in the size of the pipe, and in many systems the greater part of the cost of such maintenance is due to breaks in the pipes smaller than 4 inches in diameter, and on the whole the cost of maintaining the 3-inch system would probably be fully as great as that of maintaining the 6 inch system, so that this item will not influence the total.

In determining the extra cost of the service pipe involved by the excess of the maximum demand over the average demand it must be remembered that other considerations besides the amount of gas to b carried have a great influence upon the size of pipe that is to be laid in any given case. There is no need to go into these considerations in detail, but the practice in laying service pipes to street lamps, which furnishes a case of uniform consumption without any expectation of future increase, may be taken as sufficient proof that under no conditions would a service be laid of pipe smaller than ¾ inch in diameter. Some companies in fact lay no lamp post service smaller than 1 inch. The excess investment occasioned by the maximum demand of the consumer may, therefore, be taken only as being the difference in cost between the size of the service actually required and the minimum size, ¾ inch, that would be laid in any case. This extra investment has, of course, to be figured for the individual consumer, but for the purpose of this paper a consumer with a maximum demand of 80 cubic feet per hour will be taken. Such a consumer could be supplied with a 1-inch service, but most gas companies would lay a 1¼-inch service, and the excess investment occasioned by the maximum demand may be taken as the difference in cost between a 1¼-inch and a ¾-inch service. This difference in cost will be practically the difference in the cost of the pipe and fittings used, since the laying of a ¾-inch service would call for as much labor as the laying of a 1¼-inch service. Taking the low discount of 66 per cent. from list prices, the difference in cost between 1¼-inch and ¾-inch pipe will be 3.75 cents per foot. With an average length of service of 70 feet, this difference in cost of pipe, combined with the difference in cost of the fittings, would make the larger service cost say $2.80 more than the smaller service. If a stopcock is provided at the curb 45 cents must be added for the difference in cost between a 1¼-inch and a ¾-inch cock, making the total excess cost of the larger service $3.25. Interest and depreciation on this at 10 per cent. would be 33 cents per year. The difference in cost of maintenance between one service and the other is practically negligible, as in the case of the street mains.

In the case of meters there must be taken into consideration the question of whether a meter smaller than the present 3-light would be any cheaper than one of that size, and the meter manufacturers will probably agree that practically nothing could be saved in cost by going below the present 3 light size. The extra investment in consumers' meters involved by the maximum demand of the consumer is, therefore, only the excess cost of the meter actually set over that of a 3-light meter. For a maximum demand of 80 cubic feet per hour, a 5-light meter is ample. This will cost unset $1.40 more than the 3-light, and with a liberal allowance for the extra cost of connections and setting the extra investment occasioned by the maximum demand would not be above $2 for this class of consumer. Taking interest and depreciation at 15 per cent. in this case, on account of the life of the meter being shorter than that of the manufacturing apparatus, street mains and services, the maximum demand charge on account of meters for the case named would be 30 cents per year.

While it is rather difficult to name exact figures for the extra cost of maintenance involved by the necessity of using a 5-light instead of a 3-light meter, 10 cents per meter per year would seem to be a very liberal allowance.

Summing up the various charges as determined above, we have for the total maximum demand charge per year for a consumer with a demand of 80 cubic feet per hour:

Manufacturing plant, including holders	$2.50
Maintenance on above	.30
Street mains	1.33
Services	.33
Consumers' meters	.30
Maintenance of consumers' meters	.10
	$4.86

An effort has been made to have these figures err on the high side instead of on the low side, and in many cases it will probably be found that $4.75 would be an ample maximum demand charge for a maximum demand of 80 cubic feet per hour. If this charge varied in exact proportion with the variation in the maximum demand, this would make a charge of about $6 for a maximum demand of 100 cubic feet per hour. The items of cost to be included in a consumer's charge would be:

Complaint expense; gratuitous work; repairs to services; repairs to meters, less the amount of such repairs taken care of in the maximum demand charge; setting and removing meters; expense collection: cost of consumers' ledgers; car fare for meter readers; gas bills; expense of reading and indexing meters; salaries of bookkeepers on consumers' ledgers, of bill clerks, and of cashiers; interest and depreciation on the cost of a service of the size required to furnish gas at the average rate; interest and depreciation on the cost of a meter of the size required to furnish gas at the average rate.

The items made up of the cost of labor and materials will vary with each company, and will have to be determined by each company for itself, but it is probably safe to say that they will not exceed, in any well managed even though comparatively small company, $2.50 to $3 per consumer, where as would be the case with this system of charging it would only be necessary to set one meter per consumer. The higher figure may be taken for the purpose of this paper.

It was determined in dealing with the maximum demand charge that a ¾-inch service may be taken as the size required to supply the average demand of the ordinary consumer, and the cost of such a service of an average length of 70 feet should not be more than $8. Interest and depreciation at 10 per cent. will give a charge for this item of 80 cents per year.

It was also determined that the cost of the meter required for the average demand of the ordinary consumer might be taken as equal to that of a 3-light meter. The interest and depreciation on such a meter may be taken as $1 per year. The total consumer's charge would, therefore, be:

Expense for labor and material	$3.00
Interest and depreciation on cost of the service	.80
" " " " " meter	1.00
	$4.80

The charge per 1,000 cubic feet of gas used, to be made in connection with these maximum demand and consumers' charges, would be such as to cover all the operating expenses not specifically assigned to one or the other of the latter charges and the profit which the company is entitled to make. This charge per 1,000 cubic feet must be determined separately for each company and cannot be made the subject of a general discussion.

It may be argued that the demand and consumers' charges should be made sufficiently high to cover a portion of the profit, but such a course would not conform to the requirement that no greater profit be made off of one consumer than is made off of another when the same service is rendered to each. The maximum demand and consumer's charges make each consumer pay the cost of everything that is furnished him except that of the gas which he uses, and, therefore, the unit of service which is common to all cases after these charges have been made is the delivery of 1,000 cubic feet of gas, and all the profit must be included in the cost of this unit, if it is to bear equally upon all consumers.

This system of charging has been applied, as far as the consumer's charge is concerned, in the case of one small gas company, and each of its consumers pay 25 cents per month as a fixed charge irrespective of the amount of gas consumed, the bills rendered carrying the two items of "Gas Consumed" and "Fixed Charge." Many of the consumers use only small amounts of gas, and without this fixed charge would be a source of loss to the company, but with it they pay their own way. By the action of this charge the price paid for gas is automatically reduced as the consumption increases, the consumer of less than 1,000 cubic feet per year paying at the rate of $5 per 1,000 cubic feet, while the consumer who uses the largest amount of gas obtains it at a total price of $1.75 per 1,000 cubic feet. The conditions of manufacture and distribution are such that the equitable maximum demand charge would be very small, and it was not considered advisable to make it as a separate item. The consumer's charge is probably too small for present conditions, but the services are short and the district very compact, and as the business is developed this charge should prove adequate. If it does not, a change can be made at the proper time, accompanied by such a reduction in the price per 1,000 cubic feet of gas that the total charge to consumers of small amounts will remain practically as it is at present, while the consumers of large amounts will obtain a substantial reduction. After an experience of 18 months of this method of charging, the managers of the company are entirely satisfied that both the consumers and the company are better off than would be the case were the charge of gas simply a uniform price per 1,000 cubic feet.

Believing firmly in the justice, and, therefore, the policy of a method of charging for gas that will make each consumer pay his share, and no more than his share, of the expenses and the profit of the gas company serving him, I hope that this paper will aid the doing away with the present method of charging, under which from 20 per cent. to 25 per cent. of the consumers are served at an actual loss to the company, and an an additional 35 per cent. to 40 per cent. do not return their fair share of the profit, while the remainder return an excessive profit.

Improvements to Date in Consumers' Meters.

[A paper read by Mr. CHARLES H. DICKEY, of Baltimore, Md., at the Thirty-third Annual Meeting, American Gas Light Association, Milwaukee, Wis., Oct. 18-20, 1905.]

In taking up the subject of improvements to date for meters in general, there has unquestionably been a sufficient amount of literature and discussion in previous history for this to be passed over, and the situation taken into consideration as we at present find it. Further, it is well to consider in taking up the subject that we are taking it up more specifically on the points of latest developments, referring especially to larger capacities for the consumers' meters; and in this connection we will look at the subject from all sides to see how well and how closely we can bring theory and practice to work along the same lines. It is a fact that, from the inception of the dry gas meter, many new ideas, new parts and new devices have been suggested, and a great many of the radical changes bearing on construction, as a general rule, have been discarded after more or less lengthy trials; therefore, in making my only reference to past history, I would call to your attention that the main essential constructive parts of the original dry gas meters are yet in active operation. We do find, however, that all past history tends to show that many changes have been made, always with the view of securing a more easy and rapid flow of gas for the size of the meter; in other words, many changes have been made all tending to increase capacity.

We find, on summarizing this history, that in the early stages the 5-light meter, using this size as an example, was first designed to measure, as the name indicates, 5 lights of the then English standard, 6 cubic foot burners; or, in other words, the *working* capacity of this meter was supposed to be 30 cubic feet per hour. History shows and actual conditions now show that the nomenclature 5-light is obsolete, inasmuch as the original 5 light meter of 30 cubic feet per hour has been increased in capacity from time to time until to-day this meter is good for, under *normal working* conditions, say 100 cubic feet per hour; or, in other words, in the language of 6 foot burners, something over 16 lights—these figures being based on actual tests of standard 5-light meters as now made, under 2-inch initial pressure and with .5-inch loss.

Mr. B. H. Spangenberg, in presenting his paper to this Association last year, essentially dealt with the consumers' meter along the single line of increased capacity; but, of course, we all understand that, in referring to Mr. Spangenberg's excellent paper as simply treating on increased capacity, we appreciate that he has carefully gone into the matter, not only on the question of capacity, but also from the point as to where increased capacity is affected by wear and tear and the other resulting questions which are necessarily attendant thereto. In other words, Mr. Spangenberg's paper brings up solely the question, "What is the limit?" And in treating on this question we must also ask, "What is the standard differential?"

Further, if the gas engineers and meter manufacturers of this country, as I presume is the case, propose eventually to carry this

matter of increased capacity to sizes of meters other than 5 light, a third question arises, "What shall be the relative capacity of the other size meters to the enlarged 5-light?" And this brings up a still further question, "What is to be the unit from which we are to start, and on which all capacities for various size meters are to be based?"

Before entering into a discussion of these various questions, I wish to digress for a moment for a few personal statements (along these same lines, however), and to say that I had personally given a great deal of thought to this general subject long before Mr. Spangenberg brought out his paper for our last meeting. I had made considerable, in fact quite extensive, tests looking to the production of a series of meters that would each have a certain capacity to be rated as such, and if I had carried the matter through, would have endeavored to have in some manner secured the adoption of this series of meters as far as possible as a standard.

My idea was to divide the present 9 meters, from the 3-light to 100-light, inclusive, into say 4 or 5 sizes, which as just stated would each have a given capacity under a given differential, and my intention was that this reduced number of meters should take care of the work previously done by the 9 sizes. However, on learning of Mr. Spangenberg's intentions in connection with his paper, and recognizing the practical unnecessary duplication of work, I temporarily set aside this matter, but am frank to say still have the subject as outlined above fairly well tabulated for future reference. Since last October I have, of course, undertaken to produce meters patterned after the general outline as laid down by Mr. Spangenberg. We have in Baltimore our complete drawings, dies, molds and other data for making these meters; and we have also made a second type of meter, which has so far been merely designated as the open-top meter.

About 700 of the 5-A, or Spangenberg, meters have been made by my Company and have been put in use; and we are now making 1,250 of the open-top type meter for active service. Both of these meters will give about 200 cubic feet of gas per hour at .5 differential, and about 140 cubic feet per hour under .3 differential. The capacities of the meters range very similarly, as they have practically the same size valve ports and the same size diaphragms. Both meters carry the same gearing of 8 revolutions per single cubic foot, or in other words, to produce equal quantities of gas have to move at equal speeds.

Now, I believe that the meat of this whole situation can be resolved into 2 or 3 pertinent questions: First, are these 200 cubic foot meters theoretically correct? Second, are these meters practically correct? Third, are these meters commercially correct?

From the theoretical point of view it is entirely safe and reasonable to say that this meter is correct. We have openings or ports for the valves that take freely the required quantity of gas; we have the diaphragm to measure it, and we have sufficiently large channels to act as carriers for the gas in passing.

Taking the second question, however, "Are the meters practically correct?" I believe it can be better expressed in one single phrase, "What is the staying quality of this meter in point of wear?" which, of course, is very closely allied to the question of accuracy in proof. We have at previous Association meetings heard the meter referred to as being like the man—unless his breathing be perfect he suffers, and in comparison, unless the given quantity of gas is passed through the meter under the proper conditions the meter suffers. This comment is undoubtedly true and represents the essence of the subject taken practically.

As I wish to submit extracts from considerable correspondence which I have had on the subject of the practical ability of this meter, I will for a moment postpone discussing this point and take up the third question—the commercial value of the meter.

The very first point under consideration in commercial value is cost of the enlarged meter in comparison with cost of the old type, and, waiving for the moment the reasons or causes of increased cost which more correctly can be treated in conjunction with the subject of the practical working of the meter, we will simply grant at this moment that cost of manufacture on the 5-A meter exceeds cost on the ordinary 5-light—at the same time recognizing, however, that for work performed as expressed in cubic foot units the relative cost of the new type meter will be greatly less than the cost of the present meter. We come immediately to the commercial question, "Will the gas manager be warranted in substituting the 5-A meter for *general* use in place of the ordinary 5-light?" This point is one on which, as a meter manufacturer, I do not claim to be well informed, nor do I propose to discuss this at any length, as the schedule for meter setting varies widely with different managers. A representative of one of our very large companies recently told me that the schedule for his company indicated that his residence required a 20-light meter, which size meter was, therefore, set in service in his house. Without advising his household in any way, and as an experiment, he had this 20-light meter removed, and substituted therefor a 3-light meter. He states that this 3-light meter continued in operation for a number of months without the slightest cause for complaint in his household as to lack of gas supply. General lighting, gas stoves and everything being taken into consideration in this residence, the number of appliances on paper called for the 20-light meter above mentioned, according to the company's schedule, yet in actual service a 3-light meter covered requirements.

From my own personal point of view I consider that the 5-A meter has come to stay, and I say this unreservedly; but it has come to stay, in my opinion, to cover the need of a meter for house consumption only where the individual record shows periods of excessive demand.

How many thousands of 5-light meters are there in use? Let the gas managers examine their books and see, referring of course to their own individual territory. How much do these 5-light meters average per month in gas consumed? The examination I believe would show an average of from $3 to $4 per month. Many cases, of course, on 5-light service would show much more, but the average would be as stated. Taking such meters as show over the average, and I believe our gas managers would have a good guide as to the proper places for the installation of the 5-A meter—with those under the average, I do not think the gas consumed would warrant the increased expenditure for the enlarged meter, nor do I believe the enlarged meter would be necessary for such services. In addition to this, the enlarged 5-A meter can, of course, take care of the work now done by the present 10-light meter, and in a number of cases could be used as a substitute for the present 20-light meter. From the above I believe the present 5-light meter fills a given want, and to my mind this is a grave and important fact for the gas manager to consider. Furthermore, I believe that the large capacity meter has its place, and if in future development we find it to be as good in everyday practice as we believe it to be in theory, and as it has so far fairly demonstrated in practice, then we will find that it also can serve its purpose.

Sufficient for the commercial end of this question, I now revert to the practical end. I would say that I am awaiting with a great deal of interest additional reports from those who have been using these enlarged meters, which reports I hope will furnish something a little more definite than the reports so far received. One of the purchasers of these meters who has taken quite a quantity has so far seemed entirely satisfied with the results obtained, having experienced, as I understand from reports, but one serious trouble with the meters, and as far as we have been able to gather this trouble is entirely one of gummy valves, or of some such nature, entirely foreign to any question involving the increased speed, capacity or other new features of the meter. Quoting from such reports and letters as I have so far received I would read as follows:

"We have only had these meters recently installed, and all of them have been placed where our maximum demand figures from 150 to 180 feet. The best test we have so far is one that supplies a 7-horse power gas engine. On this meter we have a demand of 140 to 150 feet by actual measurement, and so far the meter has acted very well. We have, however, made no test on the differential required to supply this demand."

From another representative company we have as follows:

"The improvements in the new style 5-light meters over the ordinary 5-light meters are the enlarged channels and valve ports and small diaphragms, together with some minor changes, such as larger and stronger flag-posts, raising the worm so that parts will not have to be removed to repack stuffing boxes, and the increased speed. Our tests show on the ordinary 5-light meter 158 cubic feet per hour increased on the enlarged meter to 240 cubic feet per hour under exactly the same conditions. To prove the efficiency of these meters under forced conditions we compared one with an ordinary 20-light connected up with 20-light connections.

"The test showed capacity of the 20-light meter through 20-light stubs to be 420 cubic feet per hour. The new 5-light, with the same connections, except 5-light stubs, passed 360 cubic feet per hour, showing that it would easily register all gas that can be passed through the 5-light stubs."

This report goes on to discuss the various advantages of the change in fittings, small diaphragm, and other matters, but does not make any further comment of moment other than to remark in closing as follows:

"I feel justified in saying that this new meter will replace any 10-light meter, and, except for gas engines and where large pipe connections are necessary, the 20-light meter."

Reporting at later date, the representative of this same gas company writes me as follows:

"We have one of the improved 5-light special meters in use in the meter shop, set July 6th, and it has registered 23,000 cubic feet of gas, or an average of 670 cubic feet per day of 10 hours. There is no perceptible wear on the meter. It does not run as steadily as the common 5-light meter, and although the lights are not affected by this motion, it would be better to run steadily on account of the tendency to wear the parts unevenly. On the whole I should consider it a very good meter, and a decided improvement over the common 5-light meter. I should consider it a still better meter if the same capacity could be had with a slower motion of the diaphragm."

A still later report from this company shows tests on several other of the enlarged meters with results of tests indicating that the meters are taking freely fair quantities of gas and are testing from 1 per cent. to 2 per cent. slow; in other cases are testing O. K. These later reports contain the following comments:

"The meter runs smoothly and registers correctly on single pilot test, and, referring to special meter No. 20,603, tested August 15th, adjusted to exact O. K., this meter showed, after 8 days' consumption, 9,000 cubic feet; test 0.50 per cent. fast.

"Actual test has shown that these meters should not be expected to run more than 140 cubic feet per hour, as more than that will cause the Welsbach lights to flicker, on account of the rapid motion of the diaphragm."

Taking up reports from yet another representative company, I would quote the following:

"In response to your request for tests on special 5-light meters, would state that this request was received in my absence from town, and as I am going away again to-night I regret that I cannot give you at this time any definite results. With this meter the troubles experienced have been with the flag-arms, which were not strongly enough attached to the flag wires. Also the wear between the short flag-arms and the tangent bat is excessive. This simply means that the flag arms will have to be made a little stiffer and keyed to the top of the flag-wires, or else the shaft squared and a nut put on top.

"Further, that the tangent bat will have to be bushed, or else made larger in diameter and of some harder metal."

Yet another of my correspondents advises that he has not as yet had the opportunity to determine just how satisfactory the enlarged meter will prove, but that he had set one some short time previously in a factory for the purpose of measuring industrial fuel gas, the installation being estimated to consume 200 cubic feet of gas per hour. This correspondent, however, furnishes a tabulative statement of tests on two different 5-A meters and refers to same as follows:

"You will notice from the tests given in our tabulation that the best capacity we could get on these meters with .5-inch drop in pressure to be 150 cubic feet, and with a full 1-inch drop in pressure, 239 cubic feet."

These tests referred to are herewith tabulated:

Tests on 5-Light.—No. A, 50,773.—August 15, 1905.

Dif. Pres.	I. Pres.	O. Pres.	Revol. of Meter.	Cubic Feet Passed.	Duration of Test in Seconds.	Cubic Feet Passed Per Hour.
2/10	21/10	19/10	16	2	127	55.2
3/10	21/10	18/10	16	2	73.5	96
4/10	21/10	17/10	16	2	61	116.8
5/10	25/10	20/10	16	2	47	150
10/10	26/10	16/10	16	2	29.5	239

Tests on 5-Light.—No. A, 50,768.

Dif. Pres.	I. Pres.	O. Pres.	Revol. of Meter.	Cubic Feet Passed.	Duration of Test in Seconds.	Cubic Feet Passed Per Hour.
2/10	23/10	21/10	16	2	129	54.6
3/10	22/10	19/10	16	2	74	96.6
4/10	22.5/10	18.5/10	16	2	59	119.6
5/10	24/10	19/10	16	2	47	150
10/10	26.5/10	16.5/10	16	2	30.5	231.3

Taking this matter still further on the subject of reports from companies, another engineer writes us as follows:

"Attached is a copy of tests on the special 5-light meters, etc."

Pressure.			
Inlet.	Outlet.	Differential.	Cubic Feet Passed.
2.5	2.4	.1	32
2.9	2.4	.5	225
1.9	1.2	.7	300

The above capacity tests were taken on 1 meter, and this report contains further capacity tests on several other meters, these being very similar to the one quoted. The report further goes on and gives result of proof tests as follows:

Number.	Set.	Location.	Consumption.	Result of Test. Per Cent.
52,871.....	June 12	engine.	162,500	2.43 slow.
52,873.....	" 16	office.	21,900	20.00 "
52,870.....	" 16	shop.	131,300	3.38 "
52,872.....	" 14	works.	95,200	1.48 "
52,874.....	" 14	works.	208,700	0.99 "

"You will note the excessive incorrectness of meter No. 53,873. The top was taken off this meter and the meter tested on the points, showing valves to be leaking considerably on every point; back plate and sides were taken off, valves taken out, and diaphragms tested for leak, and both found tight. An examination of the valves showed that they were untrue and rocked considerably.

"In the light of the tests made, I should say that the whole trouble with the enlarged meters is in the valves. Seemingly they work too fast to remain accurate; either that, or else the workmanship and quality of material in the valve or valve seat is decidedly inferior."

A supplemental report from this same company is here tabulated:

Number.	Set.	Appliance.	Test, Per Cent.
62,152	July 11	Ruud heater.	1 48 slow.
62,149	" 7	" "	3.38 "
62,140	" 29	" "	O. K.
62,134	" 29	" "	1.96 slow.
62,147	" 20	" "	1.96 "
62,150	" 20	" "	4.76 "
62,156	" 14	" "	2 43 "
62,151	" 26	O. arcs.	0.99 "
62,153	" 26	I. "	4.76 "
62,135	" 26	" "	0.99 "

This engineer, in commenting on his superintendent's reports, writes me as follows:

"You will note from the foregoing that practically all the meters run slow. It is true that some of the meters have probably been given a much harder trial than they would naturally be put to in ordinary use. For instance, in a previous report meter No. 52,871 was used on the gas engine in our office, and passed practically 200 feet per hour from 19 to 22 hours daily, and tested 2.43 per cent. slow, passing in the aggregate 162,500 cubic feet."

A still later report from this same engineer has come to me as follows:

"The special 5-A meter, No. 52,872, received from our works on Aug. 15, upon inspection was found to contain tangent post badly worn from work. We also found that openings in the flag-arms had worn oblong. All of the special valve meters we have found out of proof thus far show that the inaccuracy is due to the imperfect seating of the valve. I think a 3-ounce cover too light to stand the increased valve travel in these special meters. The tangent in a 5-A meter makes 8 revolutions per cubic foot, which means a great increase in valve travel as compared with the ordinary meter.

"These are the only defects I can see in the meter at the present time, while on the other hand the advantages of installing 5-A special meters are many. I inclose herewith tangent post and flag-arm for your inspection, in order that you may see how they are worn."

From another gas engineer we have received comments on the new meter, as follows:

"The standard 5 light swivels and connections are used. It seems to me it would be advantageous to use 10-light connections, as too often our 5-light connections will not pass 200 feet per hour. The 10-light connections would insure better service to and from the meter, etc. The diaphragms are the 3-light size. They are specially placed so that the leather at no point touches the sides or bottoms of the meter. This, of course, lessens the friction and keeps the leather from wearing out so rapidly when the meter is located in a warm place. Also, as there is not the area of leather as in the regular 5-light diaphragm, the constant leakage will be less. On the other hand, the diaphragm must travel faster, naturally wearing out sooner. This speed is also carried to the valves, worm and other mechanical parts. As we have no way of lubricating these parts when in service, it occurs to me that if the meters are worked to their capacity, say 200 cubic feet per hour, they would wear very rapidly. Altogether, I feel confident that these meters would take care of the work now given to 10-light meters, and they are excellent meters where the demand is high only at short intervals."

Appended you will find test reports which accompanied this last communication:

5-Light Meters Tested.—August 15 1905.

Maker's No. Enlarged Meters.	Capacity Test, Cubic Feet per Hour. 50 Ft. Inlet.	50 Ft. Outlet.	100 Ft. Inlet.	100 Ft. Outlet.	150 Ft. Inlet.	150 Ft. Outlet.	200 Ft. Inlet.	200 Ft. Outlet.
52,876	16	15	16	14	16	12	16	10
52,877	16	14	16	14	16	11	16	10
52,878	16	14	16	14	16	12	16	10
52,879	16	14½	16	14	16	12	16	10
52,880	16	14	16	14	16	11	16	10
52,881	16	14	16	14	16	11	16	10
Ave. Diff.....	1 11/12		2		4½		6	
Regulars.								
27,618	16	14	16	11	16	6	16	
27,635	16	14	16	11	16	6	16	
27,638	16	14	16	11	16	6	16	Open.
27,658	16	14	16	11	16	6	16	
27,669	16	14	16	11	16	5½	16	Outlet.
27,672	16	14	16	11	16	6	16	
Ave. Diff.....	2		5		10½		16	

I have thought it advisable to quote the above reports and data as tending to show that unquestionably the trend of opinion among our engineers is decidedly favorable to the new meter, and where these reports deal with, for instance, such questions as inaccuracy in proof (as in one report) which is directly traceable to rocky valves, I feel confident in saying that if such were the only objections, being purely mechanical, they could be readily overcome. The only tentative objections really to be recognized, in my opinion, can be summarized in one phase, "Will the working parts stand the speed?" This is also a mechanical question, but as I view it a somewhat different mechanical question from the minor point of rocky valves, and my personal belief in this matter is all summed up in this one piont.

I do not believe increased speed will wear out these diaphragms, so far as the motion is concerned under such increased speed, and with the gas free from impurities I would not consider the smaller diaphragm an objection as referred to in the use of the reports as just quoted. In considering the smaller diaphragm, however, it would be well for us to bear in mind that should the diaphragm leather contract or expand, the percentage of error as resultant of such contraction or expansion will surely be greater in the 5-A meter where the speed is 8 revolutions instead of 6.

I would reason on this basis owing to the fact that as the measuring capacity of the diaphragms is contracted or expanded, the 8 revolutions for a given amount of gas passed will be affected to a greater degree than where only 6 revolutions are required for the same quantity of gas.

The only other question relative to the diaphragm brought up in the reports quoted, is where mention is made that, owing to the lessened area of leather, the constant leakage will be less. This would be correct, and would be a point to be considered, if the volume of leakage were correlative with the number of strokes made by the diaphragm. For instance, if the seepage of gas through diaphragm leather represents 1 unit of error for each revolution of the tangent, then in the old style meter 6 revolutions for a given quantity of gas would represent 6 units of error against 8 units of error for 8 revolutions of the tangent in the new meter to be equivalent to the same quantity of gas registered. This, however, does not represent the true situation. The unit of error in this case is not directly proportionate to the diaphragm stroke, as with the contraction or expansion of the measuring capacity just illustrated, but is based on other and entirely different conditions.

As is well known, gas leakage at any point is dependent upon only three items; the size of orifice or opening for leakage, the amount of pressure forcing leakage, and the duration of time for leak. Under these conditions the leakage question on the diaphragm is more favorable to higher speeds than to slower speeds, as a given opening under a given pressure would leak a relatively greater amount of gas under slow speed in comparison with the actual registration of the meter than under high speed—the percentage of error, you will note, being entirely dependent upon amount of leakage in a given time compared with the quantity of gas measured or passed through the meter in the same time.

I do not believe 8 revolutions and the necessary increased travel of valves materially enter into the question. Further, I do not believe that, even with the increased speed that sufficient wear will develop on the soft metal valve arms of heavier pattern used in 5-A meters should cause uneasiness or alarm at that point. At only one point in the meter do I consider increased speed as bringing up immediate dangers, and this point in my mind has always been, although long unrecognized, the weakest point in our dry meter construction, the joining of the flag arms to the tangent post. In one of the letters from which I have quoted mention was made of a worn tangent post, and the sample forwarded me at that time I now have, should any of the gentlemen present care to inspect the same. As just stated, in my mind this is one of the points of greatest weakness due to friction, and at the same time is one of the points where the greatest care must be taken to prevent wear, and to insure steadiness and accuracy in operation. Otherwise the meter will not only jerk and be unsteady in its differential, but will also vary greatly in proof, as wear at this point materially affects the stroke of the diaphragm through the reach of the flag-arm. The next important point in my mind in meter construction is in the strength and rigidity of the flag wire, as any give in this wire affects the stroke of the flag, and thereby affects the capacity of the meter diaphragm. As I take it, owing to the increased capacity, we do not consider high differentials in the new meter, and granting clean valves to insure free movement of the parts, the amount of resistance to the travel of the flag-wire will not be increased greatly by the speed of the meter; therefore, this point, as I have previously stated, I consider secondary to the question of the tangent post and short link flag arm.

With these special points in mind, I believe it will be necessary to make such changes in the bearings of the meters at these vital points as will insure perfect working of the meter, at the same time giving it such strength as to insure accuracy.

In summarizing, I believe that I have somewhat committed myself to a tentative approval of the enlarged capacity meter, and supplemental to my remarks on the entire situation, I would only wish to state that these, my personal views and personal actions (either as gas engineer or meter manufacturer), would be greatly governed in accordance therewith; in other words, were I a gas engineer or a gas manager, I would certainly give the enlarged meter ample opportunity to prove its merits or demerits under actual working conditions. As a meter manufacturer, viewing the matter as I do and endeavoring at all times to be progressive in such things, I shall certainly manufacture this meter, using at the same time my best ability and judgment in bringing out these meters as nearly as possible along the line of what I consider good, practical and effective work, and only careful test and practical working will finally fully demonstrate the best practice, either in manufacture or in commercial value.

Coming back to the beginning of this paper and reverting to my remarks as to my original intention on this same subject, I would say that I had in mind at that time a 5-light meter as a standard—a 5-light meter that would give, under the ordinary conditions of slow speed at a given differential, a steady flow of gas; more than the present 5-light, but not as great as the new 5-A meter; and from that point, and using that meter as a unit, I had in mind to create 4 or 5 larger size meters, each having under a given differential a certain fixed capacity. I must confess, however, I never contemplated the making of a 5-light meter to do the work of a 20-light, but rather to have the 5-light meter take care of the business as at present, having, however, the capacity of this meter sufficient to care for the ordinary consumer and his gas stove at rush hours; in other words, a 5-light meter with a capacity standardized somewhat larger than the present 5-light, but with practically an intermediate capacity between the present 5-light and the new 5-A.

I am also inclined to believe that we would be somewhat safer in the use of increased capacity meters with the higher speeds, were it possible to so arrange that, in making meters for given capacities, we could have some device that would only allow so much gas per hour to pass at a given speed. If this could be arranged I feel satisfied we would have a large part of our trouble over with. I mean by this, something along the line suggested at one of our previous meetings, of having a small check at the outlet, that when the gas consumer's demands get beyond the allowed capacity of the meter, he can report "No gas" to the office.

I have made mention early in this paper of the so-called open-top type of enlarged 5-light meter. I have entered into no discussion in connection with this meter, as I have felt that this paper was more specifically on the line of the increased speed and increased capacity, irrespective of the design of meter obtaining these results, and as I have stated the open-top type of meter being on these same general lines of speed, capacity, etc., I have felt it did not need special mention at this time. I would only say in this connection that this meter has been designed and will be used in some quantity by one of our larger gas companies. With a view in mind of greater facility in the repair of the meter, the channels are all above the table, and the loosening of one screw will allow the removal of all fittings from the valve table.

In the matter of this general subject, I have endeavored to present what I believe to be the simple facts as I look at them to-day, but I have reason to believe that there is quite a difference of opinion on the subject.

As this discussion involves points of vital interest to us all, I believe it would be a wise thing for this Association to consider at this time the appointing of a committee, say of 3, 5 or more, to make such tests as are necessary to establish proper differentials under which said tests are to be made, and for this committee to have produced what they would consider the proper number of different size meters, to designate the capacities of these various meters, and to generally go into this matter in full detail, the object being to establish standards for meter dimensions, capacities and sizes—all of which work, if properly carried out, would greatly simplify the question. This committee, of course, as outlined above, could settle the 4 original propositions mentioned at the beginning of this paper, namely, "What is the limit?" "What shall be the standard differential?" "What shall be the standard unit for meters?" and "What shall be the relative capacities expressed in units for the different sizes determined upon?"

I should be glad to do this work in connection with said committee, and, if necessary, make the sample meters on the lines as approved by the committee, submitting same as standard samples, and in any other way would cheerfully co-operate to the best of my ability. I believe this can be done, and whether the work be approved as already stated, or modified somewhat, it would unquestionably be a beginning on the proper lines.

Flame Temperature of Fuels.

The *Journal of Gas Lighting* says that a recent number of the *Zeitschrift für Beleuchtungswesen* contained an article dealing with the calculation of the temperature of the flame of fuels, based on Mahler's method, which was described last year in the *Revue Universelle des Mines*. The following is a summary of the article, in so far as it appears of interest to our readers:

A knowledge of the chemical composition and the calorific value, determined by the bomb, suffices for the practical comparison of fuels. The flame temperature can be calculated from these data. Flame temperature is here understood to mean the temperature attained by complete combustion in air at constant pressure. It is a theoretical absolute value which is not reached in practice, owing to the defective character of all heating apparatus; but nevertheless it is in many cases of the utmost value as a guide to the judgment. Mahler gave the following formula for calculating the calorific value (q), under constant pressure, of the unit weight of a fuel.

$$(\text{I.})\ q = N\ (Cm\ T_1 - Cm\ T_0)$$

in which Cm = the mean specific heat of one of the combustion gases between zero and T_0 on the absolute scale.

N = the number of molecules in "mol" volumes of 22.32 liters (the "mol" is Ostwald's term for the molecular weight in grammes).

T_0 = the initial temperature (from the absolute zero).

T_1 = the final (or flame) temperature (from the absolute zero).

Specific heat increases with the temperature, and the changes are so great at high temperatures that they cannot be disregarded. Mallard and Le Chatelier apply the following equation to express mean specific heat:

$$Cm = \alpha + \beta T$$

in which α and β are co-efficients, having the following values for the different products of combustion:

	α	β
For the permanent gases (nitrogen and carbonic oxide,	-1 6.5 × 1,000	-2 0.6 × 1,000
For superheated aqueous vapor	-1 6.5 × 1,000	-2 2.9 × 1,000
For carbonic acid	-1 6.5 × 1,000	-2 3.7 × 1.000

Taking T_0 as 273 or 0° C., and θ as = the final temperature on the Centigrade scale, and T_1 therefore as $= \theta + 273$, then inserting the foregoing values in Equation I., it becomes:

$$(\text{II.})\ q = N\left[\frac{\alpha\,\theta}{1{,}000} + \beta\,\frac{(\theta + 273)^2 - 273}{1{,}000^2}\right]$$

The value of θ can be found from this equation if the number of molecules formed by the combustion and the calorific power, stated in large calories, are known.

The following table, however, facilitates the rapid solution of this equation. The approximate value of the flame temperature will usually be known, and trials are then made with the help of the table, taking the known number of molecules, until the temperatures in the table which give the calorific values next above and below the ascertained calorific value have been found. Then for the small interval of 100° between the two temperatures no appreciable error will be introduced if the calorific values are taken as proportional to the temperature, and the exact value of the flame temperature thus ascertained. The table shows the heat, in calories, of the "mol" volume of 22.32 liters, under constant pressure, for different gases:

Temperature. Degrees Centigrade.	Nitrogen, Oxygen, Hydrogen Carbonic Oxide.	Superheated Aqueous Vapor.	Carbonic Acid
0	0.00 calories.	0.00 calories.	0.00 calories.
100	0.68 "	0.83 "	0 87 "
200	1.39 "	1.73 "	1.85 "
300	2.10 "	2.67 "	2.87 "
400	2.82 "	3.69 "	3.99 "
500	3.56 "	4.76 "	5.17 "
600	4 31 "	5.89 "	6.44 "
700	5.07 "	7.07 "	7.77 "
800	5.85 "	8 30 "	9.16 "
900	6.63 "	9.62 "	10.66 "
1,000	7.43 "	10.98 "	12.12 "
1,100	8.24 "	12.40 "	13 85 "
1,200	9.05 "	13.87 "	15 55 "
1,300	9.89 "	15.41 "	17.33 "
1,400	10.73 "	17.00 "	19.18 "
1,500	11.59 "	18.65 "	21.11 "
1,600	12.46 "	20 35 "	23.09 "
1,700	13.34 "	22.13 "	25.18 "
1,800	14.23 "	23.93 "	27.31 "
1,900	15.14 "	25.83 "	29.55 "
2,000	16.05 "	27.76 "	31.83 "
2,100	16.98 "	29.74 "	34.18 "
2,200	17.92 "	31.81 "	36.64 "
2,300	18.87 "	33.91 "	39.14 "
2,400	19.84 "	36.10 "	41.75 "
2,500	20.81 "	38 32 "	44.40 "
2,600	21.80 "	40.62 "	47.16 "
2,700	22.80 "	42.95 "	49.96 "
2,800	23.82 "	45.37 "	52.87 "
2,900	24.84 "	47.82 "	55.81 "
3,000	25.88 "	50.35 "	58.86 "

An example will elucidate the manner of using this table. There are, of course, 4 volumes of nitrogen introduced from the air with every "mol" volume of oxygen. The combustion of hydrogen will serve as an example. The equation is—

$$H_2 + \frac{O_2}{2} + 2N_2 = 2N_2 + H_2O\ (\text{gaseous}) + 58.2\ \text{cal.}$$

Thus the products of combustion of 1 molecule (2 grammes) of hydrogen are 2 molecules of nitrogen and 1 molecule of aqueous vapor, and q = 58.2 calories. Assuming the probable temperature of combustion to be between 1,800° and 2,000° C., the calorific value is reckoned by the aid of the table for 3 temperatures, viz.:

Heat of—	1,800° C.	1,900° C.	2,000° C.
2 molecules of nitrogen	28.46	30.28	32.10
1 molecule of aqueous vapor	23.93	25.83	27.96
	52.39	56.11 (q_1)	59.86 (q_2)

The true calorific value of 58 2 lies between the figures marked q_1 and q_2, and hence the flame temperature θ must be between 1,900° and 2,000° C. The difference of flame temperature over this small interval of 100° may be taken as proportional to the difference of calorific value, which is 59.86 — 56.11 = 3.75, and therefore one calorie corresponds with a change of temperature of 1,000 ÷ 3.75 = 26 7°. Consequently, the difference between the calorific value of 56 11 at 1.900° and the ascertained calorific value of 58 2 corresponds with a change of temperature of 58.2 — 56.11 = 2.09 × 26.7 = 56°. Therefore the temperature of the hydrogen flame is 1.900 + 56 = 1.956° C.

The flame temperatures of a number of fuels have been calculated in this way, and the results given in the issues of the *Journal* already mentioned. In the following table the net calorific power has been converted into British thermal units:

Fuels.	Net Calorific Power. B.T U. per Pound.	Flame Temperature. Degrees Centigrade.
Solids—		
Oak wood	7,860	1,865
Bohemian lignite	10,060	2,020
Flaming coal from Blanzy	14,500	1,990
Gas coal from the Saar field	14,600	1,950
Rich coal from Treuil	15,450	2,010
Anthracite	14,920	2,030
Pennsylvanian anthracite	14,650	2,000
Peat	10,060	2,020
Liquids—		
Ethyl and methyl alcohol		1,700
Amyl alcohol		1,850
American crude petroleum	18,720	2,000
" refined "	18,500	1,660 (?)
Gases—		
Hydrogen		1,960
Carbonic oxide		2,100
Methane		1,850
Acetylene		2,350
Coal gas		1,950
Water gas		2,000

It will be seen that the theoretical flame temperature for the solid fuels is in most cases not far from 2,000° C., which probably represents the theoretical temperature of combustion of fuels of vegetable origin. It is instructive to compare the theoretical figures for the gases with the temperatures found experimentally by M. Féry with his optical pyrometer. The comparative figures are:

	Found (Fery).	Calculated (Mahler).
Hydrogen	1,900° C.	1,960° C.
Coal gas	1,871° C. (Bunsen flame)	1,950° C.
Acetylene	2,548° C.	2,350° C.
Alcohol	1,705° C.	1,700° C.

Gas Managers and "Drummers."

By ONE OF THE LATTER, in the *Gas World*.

From the headline those unfamiliar with the technical nature of the *Gas World* and unversed in American slang might think they were about to read some article dealing with military affairs instead of controversial matter as to the necessity for the existence of commercial travellers.

If any gas manager who doubts the utility of the traveller will, for a little time, forget that he is a gas manager, and view the whole gas industry from an impartial standpoint, he will then probably get an understanding not hitherto vouchsafed to him.

The gas industry is divided into numerous groups. On the one hand there are makers of plant and machinery, manufacturers of meters, cookers, tubes, fittings, etc., dealers in coal, oils and other goods, and, on the other hand, there is a distinct, but, nevertheless, dependent group comprising gas engineers and managers, who are the buyers and consumers of these goods.

This being so it is obvious that each group forms a necessary part of the great gas industry; and certain connecting links must exist between the group of gas managers and all the others. Otherwise how can the manufacturers and contractors know what is required by gas managers, and, at the same time, keep the latter informed of any new developments in plant or scientific discovery that may assist the maker of gas in the execution of his numerous duties?

Herein lies the need of the traveller, whose duty it also is to keep his firm posted up in matters going on in gas manufacture and distribution, so that they may be able to place machinery, plant, schemes of distribution per cookers and meters, etc., before the gas manager, to their mutual advantage and profit.

A glance along the vista of past years will reveal the fact that nearly all the innovations and inventions have come from manufacturers and traders, who have only been able, in many cases, to break down the barriers of prejudice and ignorance of the value of these inventions and innovations by the employment of intelligent and tactful travellers, who have introduced to the heads of the gas undertakings the latest machine, piece of plant, or, it may be, scheme, for the successful manufacture or sale of gas. It appears to me, therefore, that the traveller is a necessary cog in the wheels of the gas industry. He has his place to fill, and that not an unimportant one.

Now, admitting that the traveller is a necessary part of his business life, it behooves the philosophic gas manager to deal with him as best he can. A little forethought, a minimum of business-like arrangement, and a courteous reception to any traveller he may wish to interview, touching at once upon the business in hand, will, I think, show that any loss of time to the gas manager should be more than repaid by the fruits of discussion and agreement.

Some managers waste more time in telling a traveller they are so busy they must be excused than would suffice to do all the business the latter has to discuss. This brings us to the personal characteristics of the gas manager. Well, he is of many grades, ranging from the almost illiterate working man, with his modest wage of 30s. per week, to the highly educated specialist in engineering and science, with an income running well into four figures. This discrepancy in wordly position is one reason why it is very difficult to get gas managers into a correct focus for a clear view and criticism. Amongst this body of men one can find types of all varying degrees of education, social standing, wealth and breeding.

In a long intercourse with them the writer has met men of great culture, men of many attainments in science and the higher branches of knowledge, courteous gentlemen of erudition and intellectual perfection. On the other hand it has been his misfortune to have business intercourse with men in good posstions in their profession who have been badly educated, imperfectly trained, overbearing in their conduct of business, swelled with a sense of their importance—discourteous louts, boorish to all whom they think they can insult without harm to themselves—men without social standing or the respect of their fellows. Such individuals have, in most instances, climbed to their positions by successful wire-pulling, and manage to retain them by tapping the cleverer brains of some of their subordinates.

When a traveller goes into a gas office to call on a manager, he can—if he be sensitive to environment—generally form a correct idea of that gentleman's personality, even should he be unknown to the traveller. An indefinable something radiates from the appointments of the place, and from the manner of the clerks therein, that guides one in his estimation of the manager's characteristics. Discourteous subordinate, discourteous chief. Business-like courtesy from the young man in the outer office generally foretells that a gentleman will greet you when you enter the *sanctum sanctorum*. But, as I have remarked before, managers of gas undertakings are of all types.

There is the gentleman who has been so busy during the past year mismanaging his works that his roll desk is a foot deep in letters and papers of all descriptions. No wonder that he is busy; no wonder that his nerves are bad and his nights sleepless—small wonder that he has no time to ask you to sit down, but must needs keep you standing whilst he rummages over his desk for a stock sheet that he never finds, and so sends you "empty away," as his disorderly brain has suddenly reminded him that he has to go down to his works to see if his tar well is overflowing. If you chanced to go with him you would find his works in a condition similar to his desk—untidy and unclean, coke a foot deep in his retort house, holders and scrubbers unpainted for years, meters, cookers and fittings stored together in a leaky shed, tar, lime, old mains and scrap iron strewed over the yard here, there and everywhere.

Go, friend, clear up your mind, your desk and your dirty works, and you for one will in future find time to spend a few minutes with a passing "drummer."

Then there is the manager who is such a busy man that he can only spend about an hour each morning at his works and office. This gentleman will tell you that travellers are a great nuisance, and that only this morning three of them were waiting for him when he reached his office at 10.30.

Well, well! If this manager would spend all his forenoons and most of his afternoons at his works looking after the business he draws his salary for doing he would find that all the travellers would not congregate at his office at one hour, as they would be sure of seeing him at almost any time, and would drop in from time to time—without causing any serious disturbance of the daily routine of our friend. So come to business a little earlier and stay a little later; and your head clerk and overworked foreman, nay, all the profession, will think the better of you for so doing.

Then there is the manager of congested liver, who comes to business in decent time enough, but who is overtaken by a lively thirst at about 11 A.M. He can generally be run to earth after this hour in his favorite hostelry, somewhere in the neighborhood of the gas works. This type has a friendly, kindly disposition, but has an objectionable habit of making one miss his lunch; and when you take an affectionate fare

well of him, about two in the afternoon, he has so far forgotten the worries of business matters as to look upon you simply as a personal friend, whom he would not dream of insulting by troubling with sordid orders.

Stop drinking and thinking beer, my friend, and spend a portion of the time saved in a friendly business chat with some intelligent "knight of the road" who may tell you of something to your advantage.

We must not overlook, either, the young engineer who has just recently been appointed manager of a medium sized works. He has been well educated, and afterwards thoroughly trained in a large gas works in the next county; and is just now busy making things hum in his new sphere. His late manager, he tells you, was "one of the old school,"—"no water gas plant or 'slopers,' you know." The old retorts are fast being ripped out to make room for 'slopers;' water gas is being introduced; in short, Widnes had better be careful or it will take second place in cheap gas—perhaps. This young fellow forgot to mention that the late manager, "of the old school," made huge profits for his undertaking without such godsends as 'slopers' and water gas, that under his careful and shrewd management the gas was of high quality and low price, and that the old man has just retired on a handsome pension, respected and beloved by all his staff. The young engineer forgot to mention these facts, not because he bears the old gentleman any ill will, but because he is so busy "changing the old order for the new," with a ruthless and unfeeling hand, that he has no time to waste on common travellers, whose accounts he is upsetting and changing, without one thought of the long friendly business relations his undertaking has had with their firms.

This gentleman's office is equipped with the latest articles in furniture and letter filing cabinets; and altogether he is very up-to-date—except in experience and caution.

Then we may glance at a little works in a country town where the manager has been a successful chief for some thirty odd years. This is a good type of man without a doubt. Intelligent, honorable and resourceful, he has guided his company through many vicissitudes; and now, in the afternoon of his life, we find him still quietly going about his business, seeing to the actual manufacture of gas from the front of his bench of retorts, keeping a watchful eye on all his plant from that point, to his governor on the outlet of his holders, surveying his meters, collecting accounts in his odd moments, encouraging consumers to hire cookers or gas fires, and giving them many a kindly hint as to consuming gas to the greatest advantage—in short, looked upon by the entire community as a guide and friend in all matters relating to gas. This type of manager has always a spare half hour for his friend the traveller, as many a friendly chat on technical matters has guided and helped him on his way.

We also have the unapproachable gas manager. We timidly submit a card to his clerk, who tip-toes towards the private office, knocks gently, and entering, carefully closes the door. There is a subdued murmur of voices, the clerk reappears, and sorrowfully announces that Mr. Manager cannot see you. Not that the latter gentleman has gone suddenly blind, be it said. Oh, no! he simply does not interview common travellers. Well, well! Providence has its use for the most weird forms of animal life, so we depart in nowise downhearted, thinking that the new patent naphthaline extractor might have been of great service to The Unapproachable One had he deigned to look at our plans.

In a roomy office in another town sits a man of middle age. His face is of the thoughtful type, with an expression of power and self-restraint one sees in the features of great commercial leaders. His desk is almost devoid of papers; a couple of letters, a few blue prints under a letterweight only being visible. The room is plainly but well furnished—no superfluous trappings here, only a few plain bookcases fronted with glass, their shelves well filled with technical books relative to gas engineering, and volumes of back numbers of the trade journals, all neatly bound and numbered.

There is an air of peace and well ordered method about the whole apartment, as there is about the man who sits there. If you were to inspect the drawing offices next door, and the big, busy, general offices below, you would find that the finely organized brain that rules them from that quiet room above had diffused its influence and methodical precision to every member of the staff. An inspection of the laboratories and testing rooms, a walk through the huge gas works close at hand, would only reveal the same nicety of detail, the same perfection of business method.

And this man who sits quietly working in his private room has arranged it all. He is always very busy, but never hurried, never excited; always a cool, shrewd, courteous gentleman, conducting the business of a successful gas undertaking. Should a traveller have the good fortune to call on such a man on business bent, he need have no fear of a chilling reception, no fear of a rebuff should he suggest some scheme or introduce some as yet untested machine to the notice of this ruler of affairs. But be careful—he is a clever man and may match his brains successfully against yours in a deal.

No time is wasted here. You may have waited a minute or two downstairs, but when you gain admittance to his room you will be greeted cordially, made comfortable by the offer of a chair—and then to business. No need here for traveller's gossip. If you talk lucidly on technical matters you will be listened to attentively. If your goods are required, and right as regards quality and price, you will get an order. If you get only a promise of an order later, don't worry; this man's word is his bond, and his diary has a good memory. Now get out, for although this manager does not hurry, neither does he waste a minute; so say "Thank you," and get downstairs.

Such are some of the types of gas managers I have met with, and it would not be difficult to give more sketches in brief, but space no doubt forbids.

In conclusion, it appears to me that travellers are a necessary part of our gas business as to-day conducted; and I think that most of the men at the head of affairs are of this opinion. While it would be absurd to expect gas engineers and managers to "fall upon the traveller's neck and weep" when he enters the offices of the former, still a little consideration, a little tact, and fellow feeling on both sides will do much to smooth the difficulties of business intercourse.

Central Station Design—An Exact Science.

In a communication to the *Electrical Review* (London) the author wrote: An American writer has counseled the youth of his own and succeeding generations as follows: "Aim high; you may not hit what you aim at; but you will shoot the higher for the aiming." It is the privilege of youth to bestow a certain amount of time and energy on the attempt to realize the ideal, and truly the world would be a less interesting place in which to live if this were not the case. When, however, this attitude of mind is exhibited by older men, and in the sphere of business, it lays itself open to adverse criticism, as having strayed out of its legitimate field of poetry or philosophy. Occasionally, even in the prosaic routine of central station work, one comes across what would appear to be manifestations of such a tendency, and in this case the results are likely to conduce to unproductive extravagance.

It is still, apparently, an unsettled problem in many minds whether a public generating station shall be regarded strictly on business lines as a revenue producing concern, or whether it shall be a sort of exhibition, attempting, and often with too great success, to cover the utilitarian with a cloak of æstheticism. Perhaps it is not altogether an advantage that the electrical industry should lend itself so aptly to æsthetic treatment, insidiously flattering the *armour propre* of the members of our local authorities and stimulating them to financial recklessness. There is beauty, no doubt, in a wonderfully swept and garnished engine room, but one would also point out the attractiveness of a favorable balance sheet.

It is only to be expected that a commercial undertaking of such mushroom growth as is that of the generation and distribution of electrical energy, should provide instances of very varied arrangements resulting from the existence of widely different conceptions as to the object, and the means of obtaining that object, of the industry.

Where progress had been so rapid, the interval between ancient and modern must inevitably be of short duration, and the reign of one type of apparatus must be superseded almost immediately, owing to the evolution of newer ideas. So much has this been the case that engineers have rushed from one extreme to another, forgetting in many cases the claims of the older type in the attraction of the new. As a natural result many of our modern power stations (if a station may be regarded as modern after having been in existence 10 years) present a most extraordinary conglomeration of plant, mechanical and electrical, of all sizes and shapes.

It is, however, a task of no great difficulty to be wise after the event, to indicate early mistakes in the light of present wider knowledge, and the points proposed for consideration here consist not so much in the choice and arrangement of a type of plant as in a glance at the general aim and the clearness of vision with which efforts have been directed towards it. Neglecting the æsthetic poidt of view previously referred to, and omitting from our inquiry such stations as exemplify it, we may

presume that, in the generality of cases, the main objects sought are efficiency and economy. Let us see how these laudable aims are in course of achievement. We need not go to older stations for examples—our present day works, now in course of erection, will yield sufficient matter for a short inquiry.

It has been said, and perhaps with some degree of truth, that "consistency is the bugbear of small minds," and one is inspired to hope that herein lies the explanation, difficult to find otherwise, of the very large number of inconsistencies exhibited in the average specification for plant. Who has not seen specifications calling for a definite steam consumption to the second place of decimals, while the methods sometimes selected for ascertaining whether the guarantees have been attained may themselves be questioned as to accuracy within 5 per cent.? Of what conceivable service can be the guarantee of combined efficiency of a generating set, when the only method of checking it involves the use of the indicator, itself subject to a possible error of quite this amount?

Whether or not the engineers responsible for these and other similar anomalies can take refuge under the quotation mentioned, it may be argued that the question at issue is not so much one of consistency as of another commodity of a much more ordinary kind, viz., common sense.

In a recent specification which came under the writer's notice several switchboard instruments of various types were called for. The ammeters reading from zero to 2,000 amperes were required to have an 8-inch scale, and to be accurate within .5 per cent throughout the range of the instrument. It is a simple calculation to see that the pointer must be true to its position within an amount not exceeding $\frac{1}{32}$ of an inch at all readings, while the needle itself would, in an instrument of this size, be probably nearly $\frac{1}{16}$ inch broad at the point. The voltmeters, and also the wattmeters, were required to come up to an equally unattainable standard, and it would appear that the engineer was not satisfied that his were even then sufficiently stringent. To give still further evidence of misdirected zeal it was specially required that the errors must be inclusive of any temperature effect; and finally the ammeters were carefully placed within 6 inches of large bus-bars, on which the current would vary in intensity from almost nothing up to 4,000 to 5,000 amperes.

The precise object of all this is not quite clear, and one cannot help wondering whether some latent vein of humor has not been rather expensively indulged to the discomfiture alike of the instrument maker and also of the station engineer. It is far from our present intention to decry or discredit exactness and accuracy; let us be exact by all means, but it is preferable to exhibit the quality in a rather more sane and less pretentious manner.

If such accuracy could be insisted upon and carried through all departments of central station plant, the works would, at any rate, be efficient, if perhaps somewhat difficult of operation. Unfortunately, however, it is usual to find that such labored exactness in detail has had the effect of allowing very serious objections to occur in the general design of the plant.

The use of the microscope is said to deteriorate the power of the eye for ordinary vision, and it is to be feared that in close attention to the small and comparatively insignificant trifles in the arrangement, the broad lines of design are frequently neglected. It would appear that the sense of proportion becomes ob cured, and the close scrutiny which should be given the *tout ensemble* is bestowed only on some of the component parts.

The question of steam consumption of generating sets was referred to previously in the present article, and may well form the subject of a somewhat fuller consideration, as it is apparently a point far too much labored. Of what advantage is it to the station engineer to possess combined sets where everything is cut abnormally fine to save a quarter of a pound of steam per kw. hour on test, when his steam range condensation, steam driven auxiliaries and leakage from joints are accountable for probably far more steam than is consumed by the actual generating plant itself?

It is to be presumed that most stations can generate from their machines at the cost of something like 25 pounds of steam delivered at the engine per unit. On examining the records of these stations we find that the average amount of steam required per unit throughout the year is in the neighborhood of 50 to 60 pounds, and in some cases considerably higher. To obtain the low steam consumption guarantee, engine clearances must be reduced to the finest possible limit, greatly increasing the liability to serious accident, and also, of course, the first cost, while, as is shown in the foregoing figures the net gain, if any, to the station is practically negligible.

In the steam turbine particularly, a prime mover for which there is undoubtedly a very wide field in the future, the clearance between rotor and case is made so slight with a view to the exaction of the last fraction in steam consumption, that one constantly hears of blades stripped through too rapid starting. It is difficult to see the use in a power station of a machine which may be very economical when running but which requires ½ hour to 1 hour's warming up before it can be set to work, and in which a comparatively trivial amount of wear in a main bearing is likely to produce disastrous results. One is aware that this is rank heresy to most consulting engineers, but one still holds to the opinion that truer economy would be achieved by sacrificing the steam consumption guarantee, in increasing the clearances somewhat, and being able to take the 5:30 train home and cultivate a peaceful habit of mind.

It should be remembered that the first essential condition in our industry is absolute reliability of supply, and secondly, economy of production. We are far from admitting that such a slight sacrifice of efficiency as that contemplated would materially, if at all, affect the latter consideration.

There is another phase of the question which a station engineer rather shrinks from advancing, viz., the wear and tear of the engineer himself. The knowledge that his work is dependent on the maintenance of a 2 mm. clearance is not stimulating to reposefulness. It may be, if the present craze for the highest test-plate efficiency is maintained, that our municipal Cæsars will be exclaiming:

> Let me have men about me that are fat,
> Sleek-headed men, and such as sleep o' nights;
> Yond' ——hath a lean and hungry look,
> He thinks too much.

Another phase of the subject of anomalies in central station design is introduced in the installation of labor-saving machinery under conditions which cannot possibly result in economy. Such examples as fuel conveying and elevating gear and mechanical stoking appliances serve to illustrate this. Such apparatus would undoubtedly form a part, and a very valuable part, of the plant of a station operating under ideal conditions, but coming to the actual and dealing with load factors which are very far from ideal, they can in very few cases justify their selection on the score of economy alone.

It is difficult to understand the attitude of mind of the councillor who votes for such embellishments, and at the same time provides unremunerative labor for the unemployed section of his constituents.

Instances might be multiplied *ad infinitum* to advocate the cause of simplicity in station design, but enough has, perhaps, been said to indicate a train of thought worthy of more mature consideration.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. W. C. Ballinger, Superintendent of the Fort Collins (Col.) gas works, died at his home in that city, 325 Mountain avenue, the morning of October 23d. He was in his 42d year.

Mr. W. H. Vollum, General Superintendent for the Suburban Gas Company, at Chester, Pa., has resigned that position, to take upon his shoulders the burden of heavier duties in a Western city. The resignation becomes effective January 1st, 1906.

We understand that control in the Lebanon (Pa.) Gas Company has been secured by New York capitalists, who it is said purchased the property on a 5 per cent. basis. The property is a very valuable one, and its guiding spirit for many years has been Major John W. Mish, a man of worth and probity.

At the annual meeting of the Boone (Ia.) Gas Company the officers elected were: President, E. G. Pratt, Milwaukee, Wis.; Vice-President, Mr. George D. Roper, Rockford, Ills.; Secretary and Treasurer, E. C. Brown, New York city; Assistant Secretary and Manager, H. E. Morton, Boone, Ia.

The regular quarterly meeting of the Grand Rapids (Mich.) Gas Light Company was held October 26th. The usual dividend of 2 per cent. was declared, as was the customary dividend of 8 per cent. on the salaries of competent employees for the first half of the year. To show that Grand Rapids demands more gas right along it may be worth noting that the Company during the current year has added 90 miles of pipe of all sorts to its distributing system.

It is reported that Mr. John I. Beggs, of Milwaukee, Wis., and associates, recently made an offer for the Kenosha (Wis.) Gas and Electric Company, that was declined by its owners, chief of whom is the estate of Mr. J. H. Kimball.

The Minneapolis (Minn.) Gas Light Company has purchased the property adjoining the south side of its general office building on South street. President Rand says that it is not the present intention to add to the office premises, but he does believe that the purchase will be of use and good profit later on.

Manager J. P. Gray, of the Homer and Cortland Gas Light Company, of Cortland, N. Y., is to be congratulated on the celerity of his work in restoring the gas supply to the twin cities, the interruption of which was caused by damage to the plant through the fire that occurred therein about a fortnight ago. The supply was cut off for less than—well, to be precise, from 1 A.M to 4 P.M. of one day.

The Leavenworth (Kas.) Light and Heating Company announces that it will be ready to supply natural gas to the householders not later than the 15th inst.

THE expert commission of three, appointed by the City Council of Montreal, Canada, to determine whether or not (and how to proceed therewith) it would be advisable to engage the city in the ownership and operation of a gas plant, was done for ere it really had begun. The Council now has named the peripatetic Prof. E. W. Bemis, of Cleveland, O., as a single commissioner to exploit the subject. Mr. W. H. Pearson, of Toronto, who had been named as one of the trinity, no sooner heard of his appointment than he forwarded his refusal to serve.

THE Rochester (N. Y.) Railway and Light Company is now comfortably installed in its new and commodious office quarters in the handsome Sibley, Lindsey & Curr building, East Main street.

THE West End plant of the American Gas Company, at Rockford, Ills., is to be greatly enlarged, as the result of a conference between Mr. S. P. Curtis, General Manager of the American Gas Company, and Mr. H. L. Whipple, Manager of its Rockford property.

THE proprietors of the Lafayette (Ind.) Gas Company are now satisfied that the cut in the selling rate, from $1.25 to $1 per 1,000, was a sensible move.

HERE'S one on a member of the Municipal Ownership League, of Chicago, which squib came to us from the "Dunn brown" city, under date of October 25th: "Addison J. Blakely, one of the most enthusiastic and potent of the 11 active stalwarts comprising the Municipal Ownership League, has paved the way to the simple life and repudiation of the 'tainted illuminants' by the introduction of the old-time candle in his home at 230 Belden avenue. Immediately heavy increase was noted in the sale of tallow dips, and grocers dug out of dark corners stocks of candles long consigned to forgetfulness and oblivion through preference of their patrons for Rockefeller's oil and trust produced gas and electric light. Meanwhile the true underlying cause for Blakely's sudden aversion to 'tainted illuminants' and the return of the disciple of municipal ownership to the light of his fathers became known through the activities of an unhonored minion of the law—the hated constable, who is not contemplated in the economy of the Municipal Ownership League when they get in the political saddle. The unfortunate officer has long been on Blakely's trail seeking satisfaction for a judgment for $32.55 against the public ownership man for trust made gas. It was when the stony-hearted trust sought to collect an aggregation of gas bills against Blakely far exceeding the historic $32.55 that the lawyer-philosopher first suspected a taint was thrown in with each cubic foot of gas. As a means of collecting the bill and relieving Blakely's wrought-up feelings the Company shut off the supply. It failed to make Blakely contribute. Instead, it brought in a new gas order from a ministerial-appearing personage of the name of Campbell. The gas delivered to Rev. Campbell and later to one Bradford, was shut off, as being merely a shield for Blakely. Here the diplomatic battle ended, the Gas Company securing judgment before Justice R. M. Scholes for $32.55. Constable Max Weiss was sent out on a still hunt for Blakely's money or valuables. After a diligent quest he returned the execution unsatisfied. Blakely is still without gas and the Company is still without its money. Watchful agents camp at the door and collectors dog his steps, but all in vain."

MR. L. L. BLAKE has resigned from the service of the Norwich (N. Y.) Gas and Flectric Company to accept a responsible position on the staff of the Galion (O.) Company.

THE name under which the concern that is to supply gas in Red Jacket, Mich., will figure officially as the Peninsular Gas Company.

AT the annual meeting of the shareholders in the Mansfield (O.) Gas Light Company the officers chosen were: Directors, C. W. Upson, J. J. McIntyre, William C. Hedges, W. S. Kerr, H. M. Weaver, Joseph Hedges and James P. Seward; President, C. W. Upson; Vice-President and Treasurer, J. J. McIntyre; Secretary and Superintendent, William C. Hedges. The executive management of the Mansfield (O.) Electric Light and Power Company is virtually similar to that named above.

"S. J. R.," writing from Rochester, N. Y., under date of October 30th, says: "Mr. Owen Cassidy, Receiver for the Watkins (N.Y.) Consolidated Gas and Electric Company, having made his final report and accounting, the property has been restored to its owners, the Messrs. Horn, of Jersey City, and Mr. Martin L. Driesbach, of Philadelphia. The title of the Company has been changed to that of the Watkins Illuminating and Power Company, and it is capitalized in $50,000. Mr. E. L. Murray has been retained as Superintendent.

THE Union Railway Supply Company, of Philadelphia, having satisfactorily completed its guarantees, respecting the construction and initial operation of the new plant of the Georgetown (Del.) Gas Company, the works have been accepted by the actual owners. The gas suply was commenced September 1st. The builders agreed to put in free of charge the first 100 services applied for, and that number was reached some time ago, but the Company has determined to continue the practice until January 1st.

MR. S. E. WOLFF, Manager of the Jackson, (Mich.) Gas Company, has been promoted to the position of Assistant Manager of the Saginaw (Mich.) Gas Company.

THE Board of Public Works, of Newark, N. J., has been advised by a special committee, named some time ago to consider the matter, that it would be a good thing if the city built and operated a plant to supply electric currents for street and public buildings' lighting. As a sequel to this report City Counsel Joseph Coult has been instructed by the Board to examine the laws for the purpose of determining whether the city may so engage legally.

THE betterments on the plant of the Hollister (Cal.) Light and Power Company have been completed, and the Hollisterites are greatly pleased over the excellence of the gas supply that is being furnished them.

DESPATCHES by way of Buffalo, N. Y., aver that the Lockport (N. Y.) Gas and Electric Company has been granted a franchise by the Common Council permitting it to increase its business scope in that it may hereafter supply steam on power account to the residents and also to furnish refrigeration from a central station.

IN the organizing of the Board of Gas Trustees Wheeling, W. Va., municipal gas works, no change was made in the executive management, the staff being as follows: President, H. W. McClure; Secretary, William Schenk; Superintendent of Works, Frank Thompson; Superintendent of light plant, H. C. Underwood.

THE Northwestern Gas and Electric Light Company, of Walla Walla, Wash., has notified its shareholders that a meeting will be held in that city, December 21st. the purpose of the same being to consider a proposition to increase the capital from $650,000 to $1,000,000.

THE Chairman (Ald. Sinclair) of the Gas Committee of the City Council, of Belleville, Can., recently asked for the passage of a by-law to reduce the gas rate from $1.50 to $1.25 per 1,000 cubic feet. The by-law, however, was rejected on the ground that the gas plant (it is a municipal one) did not show sufficient profit to warrant such a cut. Ald. Sinclair's argument included a statement to the effect that the receipts for the first 10 months of the year were $13,000, and the expenditures had been a trifle over $8,000.

"IN the last week of October, Mr. J. E. Philbrick, Superintendent of the Brockton (Mass.) Gas Light Company, was visited at the office by a delegation from the employees of the Company, and before the 'brick' could be thrown, Eugene Monohan stepped to the fore and, handing to their surprised 'boss' a neat purse, spoke this piece: 'We, the employees of the Brockton Gas Light Company, have met to congratulate you upon your approaching wedding. As your treatment to all alike, apart from creed, color, race or politics, has been without discrimination, we one and all commend you for your integrity, and trust that long life and happiness may be the lot of yourself and yours.' The 'Super,' staggering under the weight of the purse, for in its folds were several double eagles, and perhaps a bit from emotion, eventually managed to thank the boys in his own hearty way, and that which came later will not be forgotten for some time. Mr. Philbrick's 'best one' is from Roxbury, Mass., and that they may forever happy be is the wish of W. A. W."

MR. HOMER M. EATON, Assistant Manager of the Jackson (Mich.) Gas Company, will likely succeed Mr. S. E. Wolff as Manager, whose promotion to the Saginaw-Bay City Company is noted above.

THE new owners of the Union Gas and Electric Company, of Bloomington, Ills., are like their main moving spirit—Mr. J. T. Lynn—for they have put the net selling rate at $1 per 1,000 cubic feet on all account and service. The concession becomes effective January 1st.

MR. EMORY P. DAVIS, Superintendent of the Mount Clemens (Mich.) Gas Company, is arranging for a reduced selling schedule. In fact, we believe the "card" has been compiled, but we have not been officially informed thereto.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, NOVEMBER 6, 1905.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

NOVEMBER 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$75,177,000	100	181	184½
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	10g
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	275	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	111	114
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's.	1,250,000	1,000	105	107
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106½	108½
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	999,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	189	190
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	3/16	¼
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works....	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	106	106½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	103
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	86¼	88
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	110	110½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100		
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind	1,000,000	100	..	60
Bonds	1 000,004	1,000	60	65
Louisville	4,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	104¾	104½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500.000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104¼	1 5¼
San Francisco, Cal.	15,800,000	100	58¼	58¾
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465.000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	.
Washington, D. C	2,600,000	20	296¼	216¾
First mortgage 6's	600,000	..	.	..
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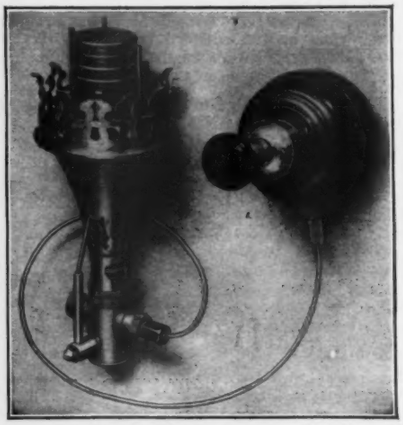

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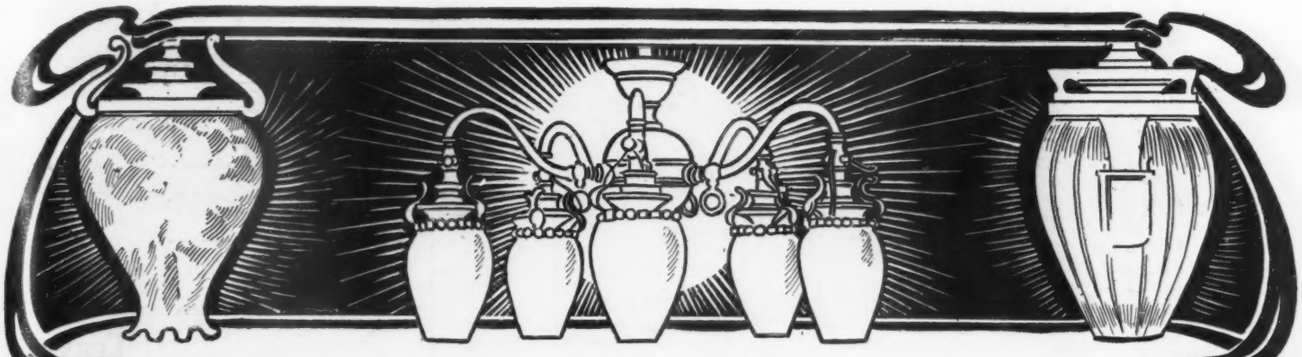

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In point of decoration this lamp admits of every feature possible with the electric light, and we have secured the markets of Europe and America with the result of adding the Ramsdell Inverted Gas Lamp the widest range of most beautiful and original designs ever offered with any lamp.

THE SIGNIFICANCE

of this remarkable lamp to Gas Manufacturers cannot but be as plain as day. Its ready acceptance and continued use by consumers everywhere--by all who test it--means sales of gas upon a plane never approached before. Its success in America will be a duplication--upon a much greater scale--of that of the New Inverted Gas Lamp in Europe. These facts are indisputable.

WRITE TO-DAY!

for our handsome, new catalogue, and send us *as soon as possible* a list of your probable needs. It is necessary for us to arrange in advance for prompt shipment. We are offering two special inducements to those who are first in touch with us. Address:

THE RAMSDELL INVERTED GAS LAMP CO.,

GEO. G. RAMSDELL, Pres.,

530 Broadway, New York.

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COAL & WATER GAS
APPARATUS,
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BY PRODUCT MACHINERY.
COMPLETE GAS PLANTS.

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Send for Pamphlet on Patents.
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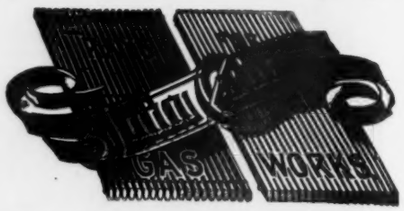
Church's Patent Trays.
Reversible; Strongest; Most Easily Repaired.
Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.
We also Supply the Cheapest and Strongest
•Reversible Bolted Trays•
IN THE MARKET.
SEND FOR BOOKLET AND CIRCULARS.

Telpher for handling coal and coke at works of Worcester Gas Light Co., Worcester, Mass. Capacity of hoist, 5,000 lbs. Travelling speed, 800 feet per minute.

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in handling all kinds of material lays special claim to economy of operation. One man can control the loading, hoisting, conveying and unloading. Obstructions heretofore considered insurmountable easily overcome. Shall we outline plan for its application to your plant?
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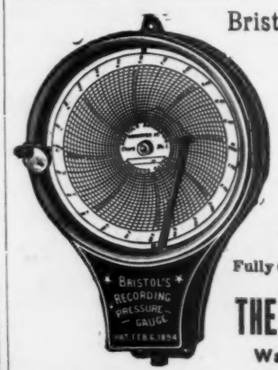

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PRESSURE GAUGE.
For continuous records of Street Gas Pressure.
Simple in construction, accurate in operation and low in price.
Fully Guaranteed. Send for Circulars.
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HOMOGENEOUS CONSTRUCTION ~ PERFECT FINISH ~ LONGEST CONTINUOUS LIFE.
WE HAVE RETORTS MAKING GAS TO-DAY THAT HAVE BEEN IN CONSTANT USE FOR 52 MONTHS.
Awarded the Only GRAND PRIZES At St. Louis Exposition
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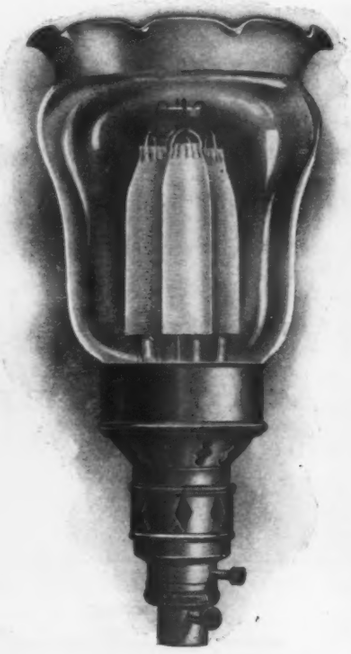


MARTIN MULTIPLE BURNER.

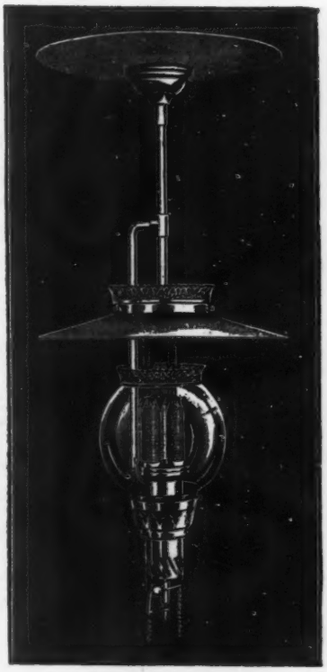
The Reason Why.

YOU see, it's this way: When we tell you that the Martin Multiple Burner will give more light per cubic foot of gas consumed than any other burner made, you may say to yourself, "That's only what the maker claims."

But when we tell you that we will *positively guarantee* that the Martin Multiple Burner will give more light per unit of gas than any other burner, and that *we stand ready to prove it* by any and every test, then our proposition ought to command your serious attention. And when we finally tell you

THE REASON WHY

then you will realize the truth of our claim that *the Martin Multiple Burner solves the problem of incandescent gas lighting—solves it for everyone and solves it for you.*



DOORENBOS ARC No. 1.
BEST IN THE WORLD.

THE MARTIN MULTIPLE BURNER

is an open Bunsen having four burners, each with its own mantle. The absence of screens or caps increases efficiency by removing resistance.

The four small mantles also increase efficiency by providing a larger incandescent lighting surface. That's the whole thing in a nutshell.

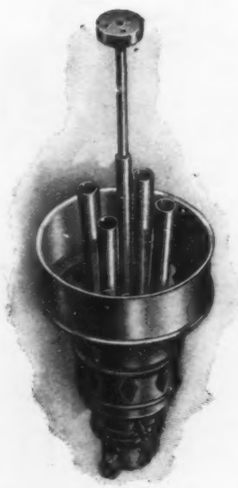
It explains why *photometric tests show a superior efficiency of 25 per cent. to 30 per cent. for the Martin Multiple Burner over any other burner on the market.*

DOORENBOS OUTSIDE ARC.
BEST IN THE WORLD.

It has perfect control of both gas and air, can be instantly regulated to any gas, can be used on any gas fixture, has a standard fitter, and carries any glassware.

The Doorenbos Gas Arcs

are used exclusively by over 300 gas companies in the U. S. If you are not one of them and are having any trouble with the arcs you are using, we guarantee to stop that trouble with the use of the Doorenbos. It won't cost you anything to give this a trial. Put the responsibility on us. Write to-day for our plan.



MARTIN MULTIPLE BURNER.
NO CAPS OR SCREENS.

J. H. T. MARTIN COMPANY,

INCORPORATED.

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WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.—We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

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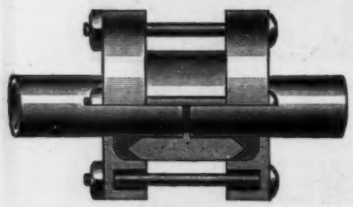
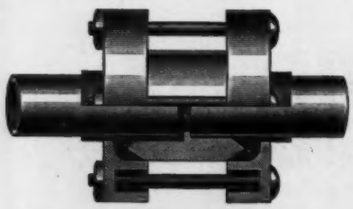
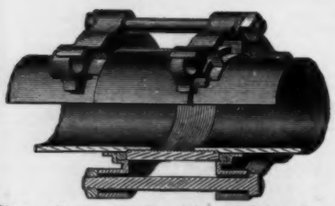
Gold Medals awarded by the Louisiana Purchase Exposition at St. Louis, for fireclay gas retorts, gas retort benches, firebrick and setting tiles.



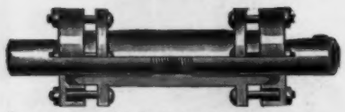
Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe.



Clamp, Style 4, for Repairing Leaks on Screw Collar.



Long Sleeve, Style 2, for Mending Broken Lines.

S. R. DRESSER,

BRADFORD, PA., U. S. A.,

Patentee and Manufacturer of Specialties for Gas and Water Lines,

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

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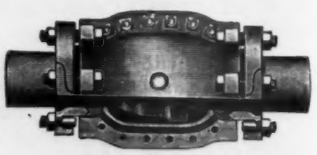
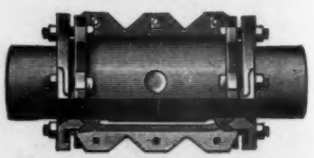
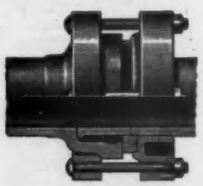
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



Clamp, Style 4½, for Repairing Leaky Lead or Cement Joints in Cast Iron Pipe.

STEWARD'S EASTERN DEPOT.

For the convenience of Eastern gas companies and dealers we now have a full stock of Steward Burners and Lava Gas Tips in New York city. Your orders will be filled promptly.

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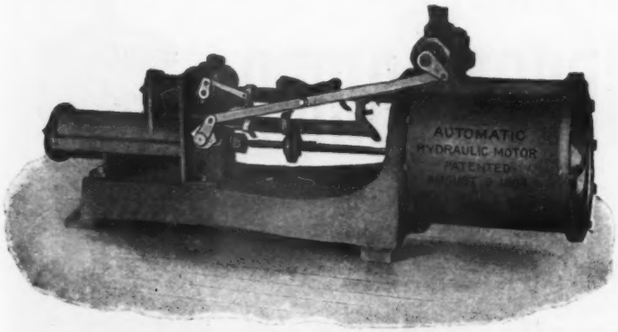

will more than double the candle power of the ordinary mantle light. Get particulars. Leased to consumers through gas companies only. An interesting and liberal proposition will be submitted to gas companies for the asking.

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HEAT PROOF AND DAMP PROOF PAINTS

For Structural Iron and Steel, Gas Apparatus, Underground Piping, Boiler Fronts, Stacks, etc.

Our Paints will not crack, peel or scale. Heat does not affect them. They are moisture proof.

They are the Paints that Don't Come Off!

We let you Try before you Buy. Send for samples and prices.

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1707, Wall Street Exchange Building, New York.

HUMPHREY OVAL GAS HEATERS,

THE FINEST COMBINED GAS HEATERS AND GAS HOT PLATE IN THE WORLD. THOROUGHLY PRACTICAL.

Heat with the whole of it.

COMPLETE SECTIONAL VIEW.

Cook with the half of it.

OPERATION.

The coldest air lies next to the floor always. The Humphrey Oval (see illustration) takes the cold air from the floor, heats it hot and forces it out at the side. Other stoves allow this heat to rise directly to the ceiling without being diffused through the room, thus taking a long time to heat the room, wasting time and fuel.

Height, 16 inches. Weight, 4¼ pounds

Price, polished nickel, per dozen.... $24

Not sold in less than dozen lots.

Liberal Discounts and Prompt Shipments. :: :: :: ::

Why not send us an order to-day for your season's requirements?

For every hot water need, use a Humphrey Crescent Instantaneous or an Automatic Water Heater. :: ::

Divides in the middle. No nuts, bolts or screws.

When not in use, or to pack, pull the legs out, untwist the burner and pull it out, tuck one-half of the jacket inside the other and lay the legs and burner in the bowl. A child can do it, and, when done, it occupies a very small space.

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HUMPHREY

Nickel Cylinder Lamps,

Used either with or without shades. Supplied with round or pear globes. :: ::

Just the lamp to offer the hesitating consumer who wants a different design.

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General Gas Light Co.

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THE CONNERSVILLE BLOWER CO.

Stand so High in the estimation of those using them?

THE ANSWER IS IN THREE WORDS:

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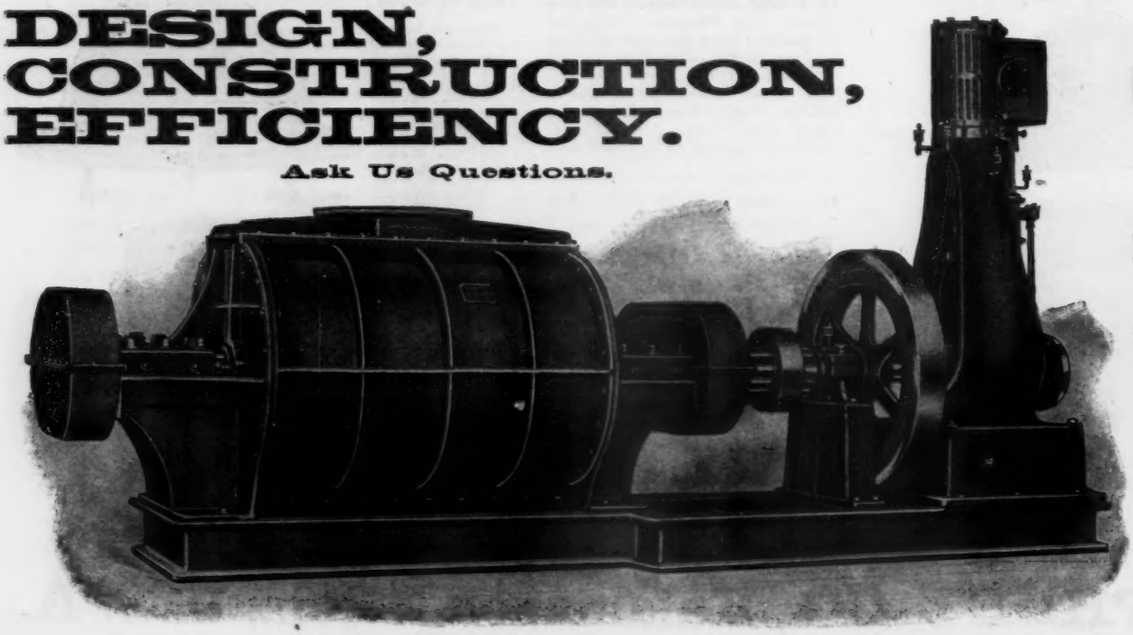

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Write us about our Improved Stuffing Boxes.

Something Entirely New.

THE DARK SEASON

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And there is no better way for the progressive gas man to take advantage of this season than to see that his consumers are supplied with perfect gas burners.

THE BRAY BURNER

Is so well known, so thoroughly tried and so universally used that there is never a doubt as to what burner the gas man will use.

All the leading Gas Companies are and have been using

BRAY BURNERS

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Double and Single Gate Valves, ¼" to 72",

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For running coal from the front of the wharf to the storage bin or pocket. One man only is needed for the operation.

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The Dodge Conveyor

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IMMERSION WASHERS.

A design embodying particularly desirable features.

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MUELLER GAS MAIN TAPPING MACHINES.

"SWIVEL NO. 1" MACHINE.

C—1004.

If it were seen, after fastening a machine to the pipe, that the position of the feed yoke wasn't convenient for the best use of the handle, the only remedy with most machines would be in removing the machine and turning it around on the pipe because the feed yoke is fixed.

In Mueller Swivel Gas Main Tapping Machines the gooseneck or feed yoke is swiveled to the machine and can be adjusted to whatever angle that will best accommodate the handle movement. Such convenience is available at any stage of the work without loosening the machine.

Mueller Gas Main Tapping Machines are made in seven different styles for different classes of work, and make taps from ⅝ to 3-inch in any size of pipe. The machine illustrated is Mueller Swivel No. 1, which makes taps from ⅝ to 2-inch in pipes from 4 inches to the largest.

Each machine is carefully inspected and assembled, is given a working test, bears the Mueller trade mark, and is *unconditionally guaranteed.*

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Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

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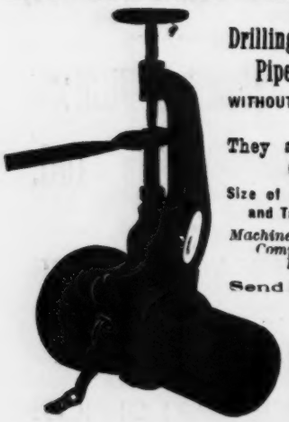
Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.



Geo. Light,
DAYTON, O.

MUELLER
DRY PIPE TAPPING MACHINE.

C—1008.

Mueller Dry Pipe Tapping Machines, including the Mueller "Regular," "Our Special" and "Our Special No. 2," comprise a line unequal for their class of work. They are made strong, are easily attached to the pipe, and are easy to operate under all conditions of use. All dry pipe machines make taps from ⅝ to 3-inch in any size of pipe. Unconditionally guaranteed. Catalogues upon application.

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THOUSANDS IN USE WITH INCANDESCENT BURNERS.
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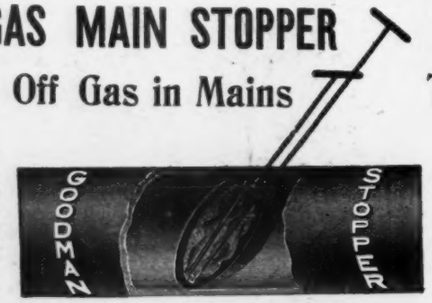
For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



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Send for our BOOK "AG," giving information for designers of power plants, and ask also for our new Catalog of Fans, Blowers and Exhausters.

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CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043, PHILADELPHIA, PA.

FINANCES OF
Gas and Electricity Manufacturing Enterprises,
By WM. D. MARKS. Price, $1. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

NOVEMBER, 1905.

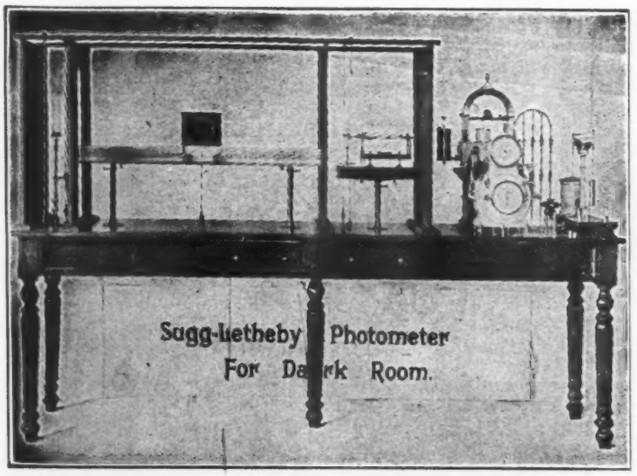
Table No. 1.
FOLLOWING THE MOON.

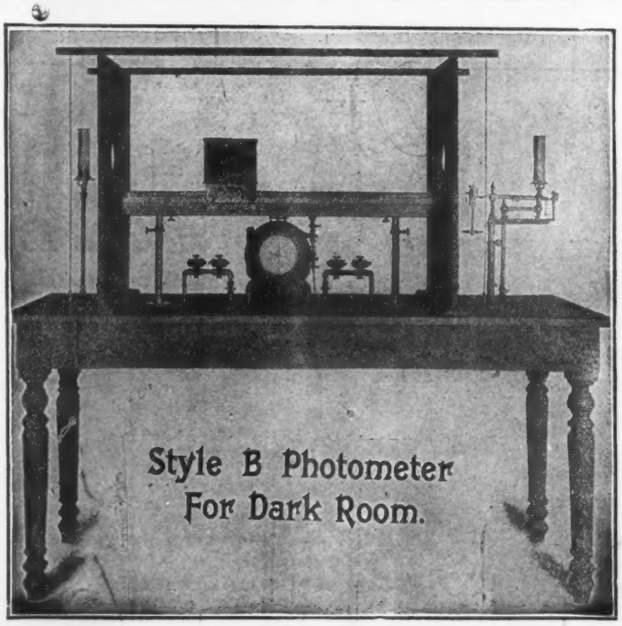
Day of Week.	Date.	Light.	Extinguish.
Wed.	1	8.10 PM	5.30 AM
Thu.	2	9.10	5.30
Fri.	3	10.10 FQ	5.30
Sat.	4	11.10	5.30
Sun.	5	12.10 AM	5.40
Mon.	6	1.10	5.40
Tue.	7	2.00	5.40
Wed.	8	3.00	5.40
Thu.	9	4.00	5.40
Fri.	10	No L.	No L.
Sat.	11	No L. FM	No L.
Sun	12	No L.	No L.
Mon.	13	5.10 PM	7.10 PM
Tue.	14	5.10	7.50
Wed.	15	5.10	8.30
Thu.	16	5.10	9.30
Fri.	17	5.10	10.20
Sat.	18	5.10	11.20
Sun.	19	5.10 LQ	12.30 AM
Mon.	20	5.10	1.30
Tue.	21	5.10	2.40
Wed.	22	5.10	3.50
Thu.	23	5.10	5.50
Fri.	24	5.10	5.50
Sat.	25	5.10	5.50
Sun.	26	5.10 NM	6.00
Mon.	27	5.10	6.00
Tue.	28	5.10	6.00
Wed.	29	5.10	6.00
Thu.	30	5.10	6.00

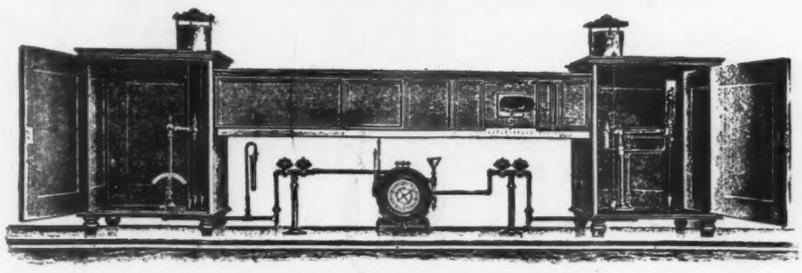
TOTAL HOURS DURING 1905.

By Table No. 1.

	Hrs.Min.
January	240.50
February	192.20
March	207.00
April	175.10
May	161.00
June	139.50
July	149.00
August	161.50
September	173.00
October	205.00
November	211.00
December	229.00
Total, yr.	2245.00







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

NOVEMBER, 1905.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Light.	Extinguish.
		P. M.	A.M.
Wed.	1	4.45	5.35
Thu.	2	4.45	5.35
Fri.	3	4.45	5.35
Sat.	4	4.45	5.35
Sun.	5	4.40	5.45
Mon.	6	4.40	5.45
Tue.	7	4.40	5.45
Wed.	8	4.40	5.45
Thu.	9	4.40	5.45
Fri.	10	4.40	5.45
Sat.	11	4.40	5.45
Sun.	12	4.30	6.00
Mon.	13	4.30	6.00
Tue.	14	4.30	6.00
Wed.	15	4.30	6.00
Thu.	16	4.30	6.00
Fri.	17	4.30	6.00
Sat.	18	4.30	6.00
Sun.	19	4.25	6.00
Mon.	20	4.25	6.00
Tue.	21	4.25	6.00
Wed.	22	4.25	6.00
Thu.	23	4.25	6.00
Fri.	24	4.25	6.00
Sat.	25	4.25	6.00
Sun.	26	4.20	6.10
Mon.	27	4.20	6.10
Tue.	28	4.20	6.10
Wed.	29	4.20	6.10
Thu.	30	4.20	6.10

TOTAL HOURS DURING 1905.

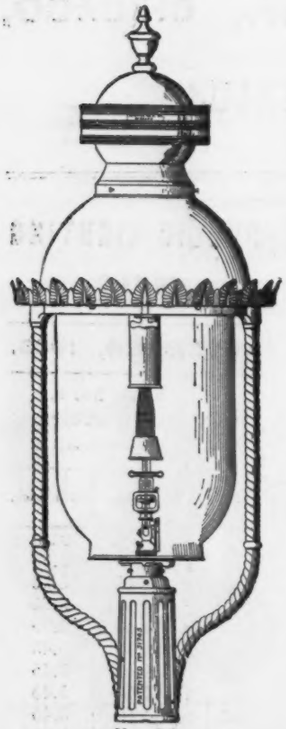
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 30.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

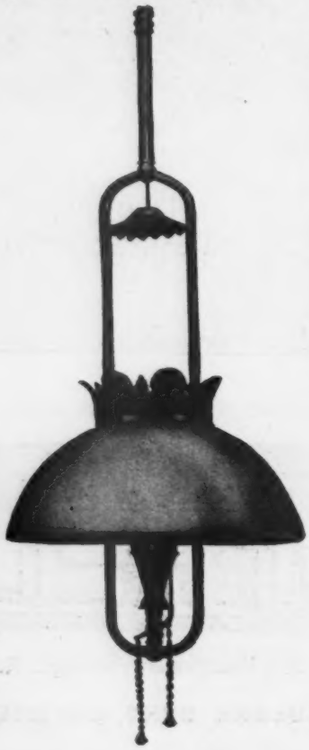
Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45 00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.



Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

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Detroit, Mich. (2d contract).	**New Britain, Conn.**	**Hamilton, O.** (2d contract).
Springfield, Ills.	**Ludington, Mich.**	**Indianapolis, Ind.** (2d contract).
Oneonta, N. Y. (2d contract).	**New York,** Mutual Co. (2d contract).	**Hazleton, Pa.**
Pottsville, Pa. (2d contract).	**St. Louis, Mo.** (4th contract).	**Mahanoy City, Pa.**
Evansville, Ind. (2d contract).	**Sioux City, Ia.** (3d contract).	**Nanticoke, Pa.**

TOTAL SETS TO JULY 1ST, 1905, ... 585
TOTAL DAILY CAPACITY TO JULY 1ST, 1905, . 455,980,000 CU. FT.

The United Gas Improvement Company,

Broad and Arch Streets. Philadelphia.

Established 1858. Incorporated 1890.
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An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

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Modern Coal Gas Benches,

With either Horizontal or Inclined Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

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Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

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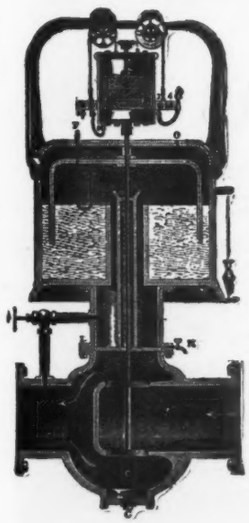

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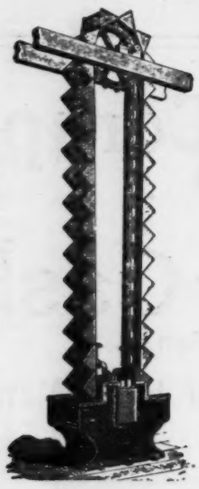

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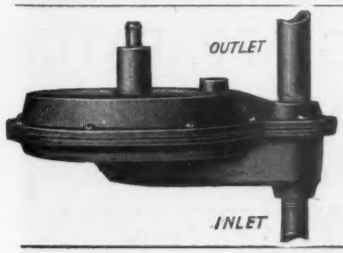

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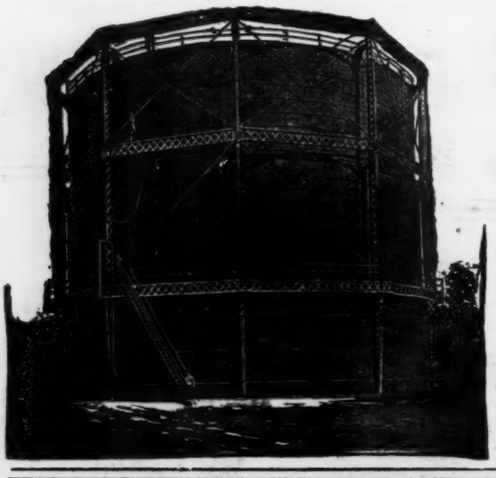

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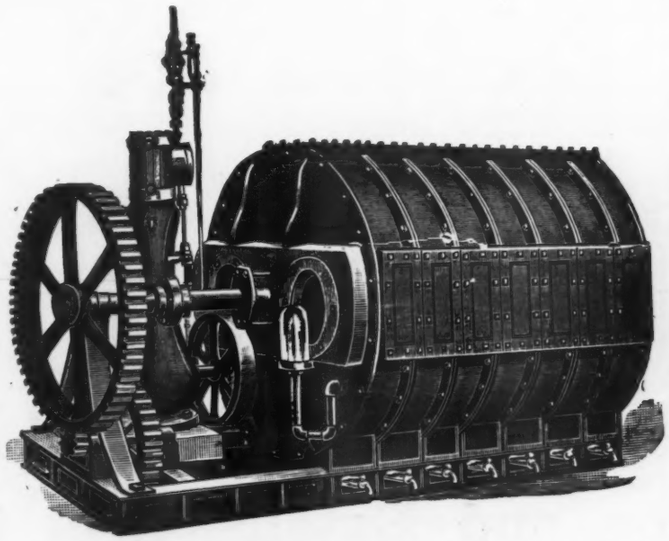
Designers and Builders of Gas Works.



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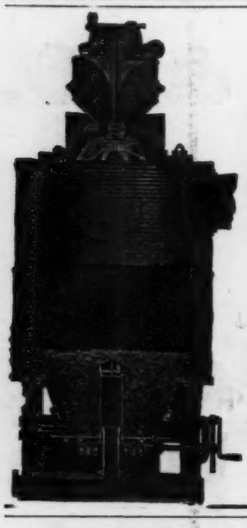

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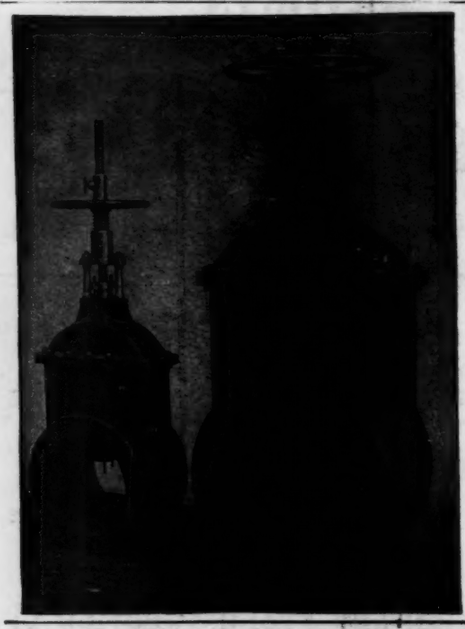

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Face to face of flange...	12 inches.	2 inches.	12 inches	14 inches	17 inches	20 inches	21 inches.	23½ inches.

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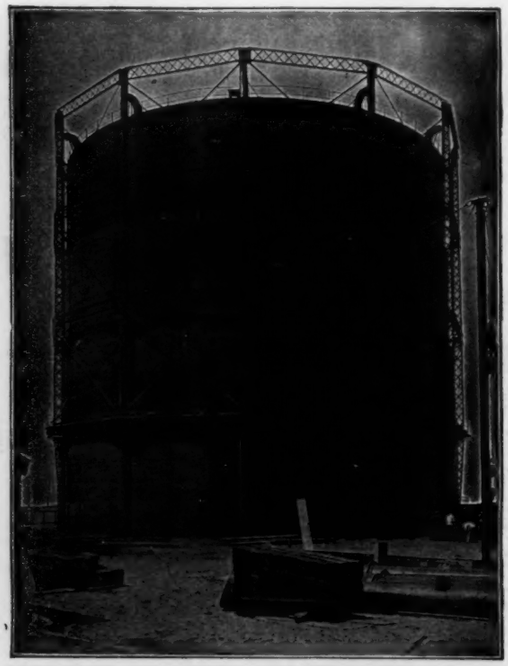

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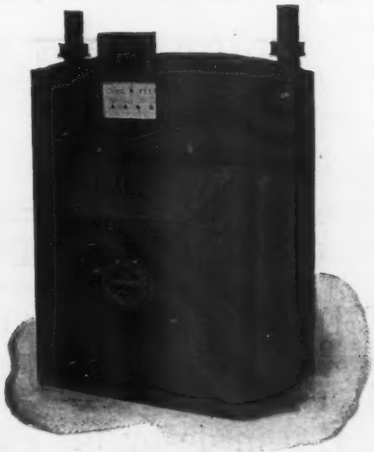

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—OF THE—

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MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir: I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners, with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

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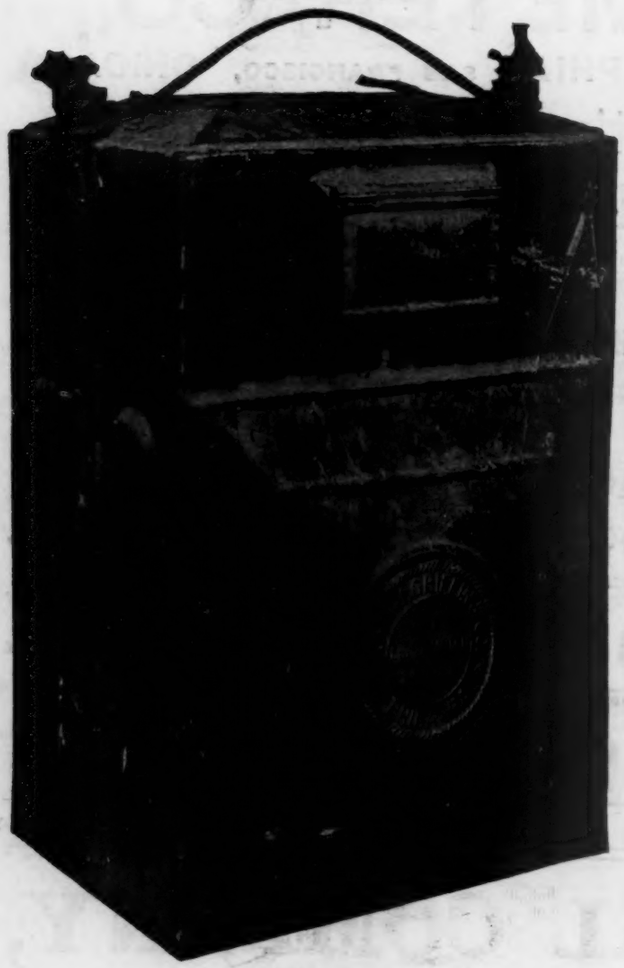

This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

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